



ON ACID & ALKALI. - F. ANDRE. - 1689.







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MEDICAL SOCIETY OF LONDON

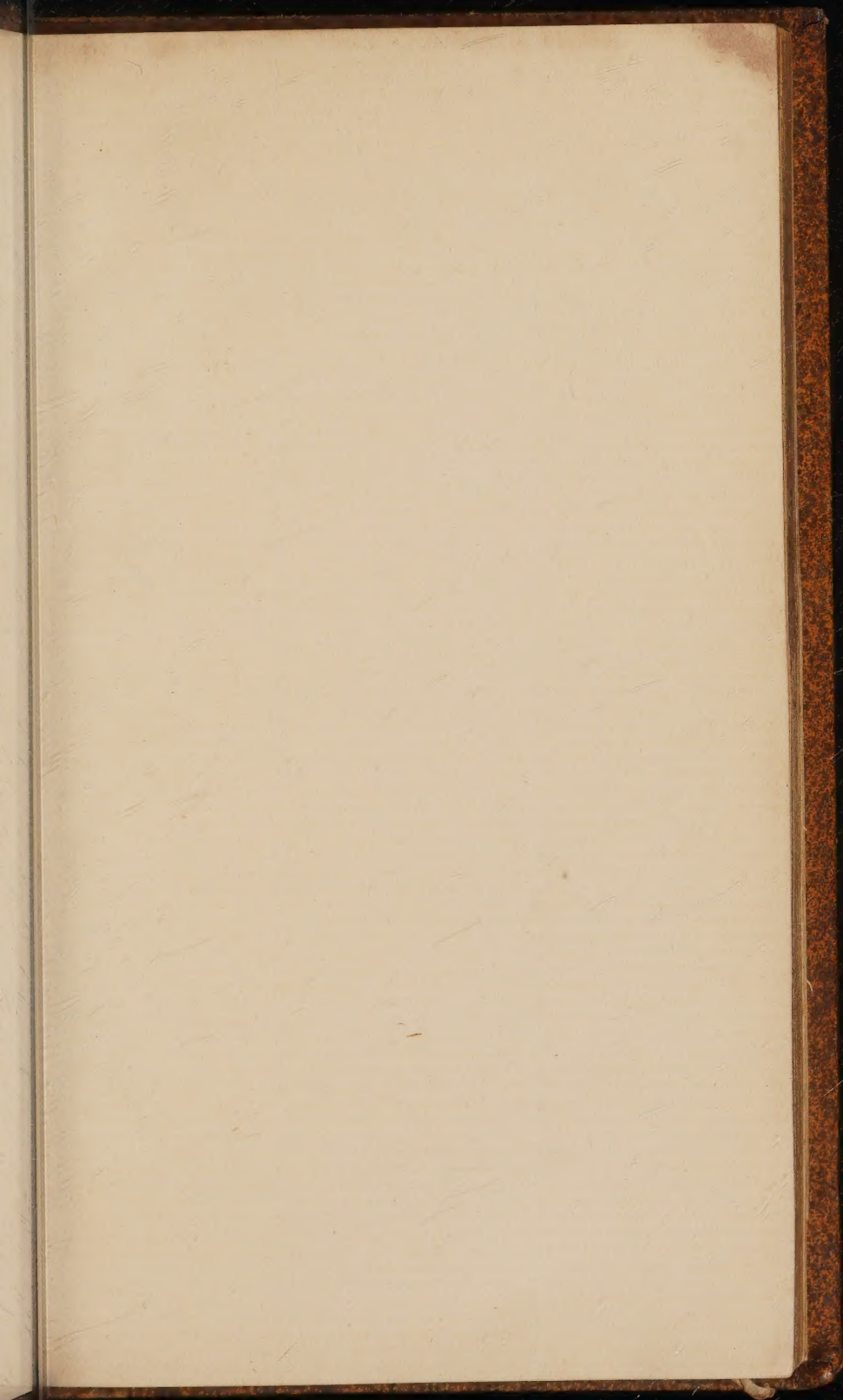


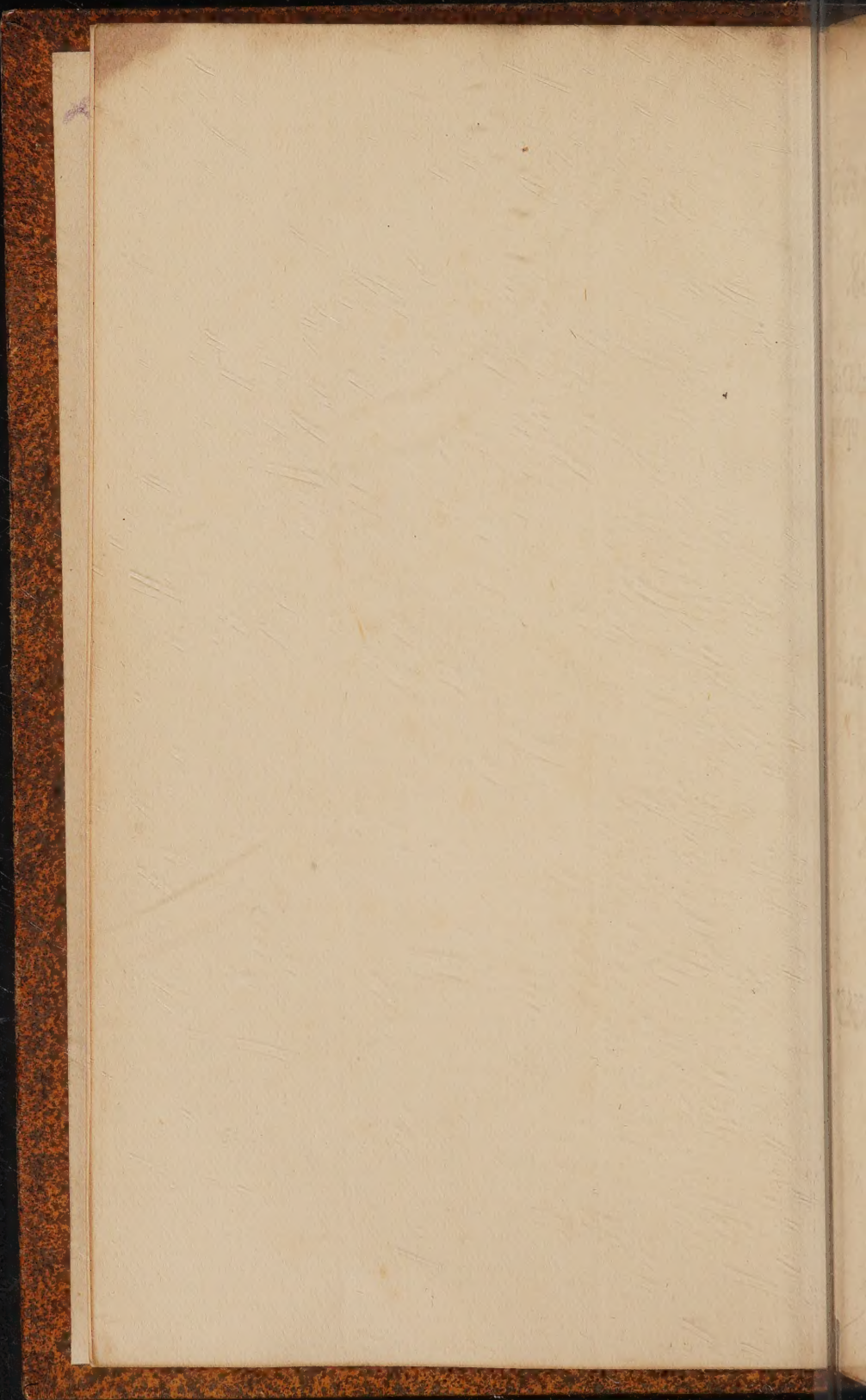
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Septemb. 26. 1688.

Libellus cui Titulus, Chymical Dissertations, or Discourses upon Acid and Alkali, &c.

Imprimatur,

*Tho. Witherly, Æq. aur. Col. Med.
Lond. Præses.*

Pe. Barwick

Joh. Elliot

Rob. Pitt

Joh. Bateman

} Censores.

LONDON. M.D.C.
Dys
Chymical Disceptations :
OR,
DISCOURSES
UPON
ACID and ALKALI.
Wherein are Examined the
OBJECTIONS
Of Mr. Boyle against these
PRINCIPLES.

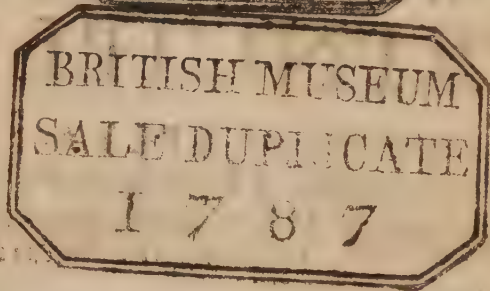
Together with a REPLY to a Letter of
Mr. S. Doctor of Physick, & Fellow of the
Colledg of ***, wherein many Errors are
corrected, touching the Nature of these
two SALTS.

By *Fran. Andre*, Dr. in Physick, of the
Faculty of Caën.

Faithfully rendred out of French into Eng-
lish By *J. W. Philodéus*.

To which is added, by the Translator, a Dis-
course of Phlebotomy, shewing the Abso-
lute Evils, together with the Accidental Be-
nefits thereof, in some Cases.

London, Printed for *Tho. Dawks*, on Addle Hill
in Carter-lane, and *Benj. Allport*, at the white
Horse in Little Britain. 1689.





THE Translator to the READER.

Kind Reader,

I Have here presented Thee with an Excellent Treatise of a learned French man in an English Dress, and though, perhaps, it be not a la mode, and consequently the less acceptable to vulgar Spirits; yet, to the Learned and Impartial Readers, it will appear a Work of no small Worth, especially when they shall Justly weigh those Solid Reasons the Author gives in Defence of the Hypothesis of Acid and Alkali, and the Weakness of those Objections against it: the first being deduced from Reason and Experience, and the last only from over-curious Supposition: The Work pleads so sufficiently its own Worth, that all Commenda-

The Translator

tions come much short of it. 'Tis a Book so Useful and Necessary in Dispelling those Mists of Ignorance we at present generally labour under, that 'tis Pity Our English Tongue was not honored with it from a more accomplish'd Pen, long before this; seeing it is a Book which more particularly concerns us than any other Nation, in respect, That that learned and Ingenious Person that made those severall Reflections against this Hypothesis (which this Author hath fully and civilly answered) is one of our own Country men, and a man of no small Eminence, which, perhaps may be one Great REASON why this never learn'd the English Tongue in publick 'till now.

As for the Translation, I hope 'tis perform'd as near the Author's Mind as possible, seeing I have all along, and especially in the most material Places, confin'd myself to the Words of the Author; therefore per-

to the Reader.

perhaps some places may at their first perusal appear a little difficult (especially to a Tyro in this Hypothesis) because they relish a little of the French Idiom: however, I hope, It is not so much wandred from English Sense, but that those of the meanest Capacities may readily enough enjoy the true meaning: Thus by your kind Acceptance of This, you will oblige me to serve you further,

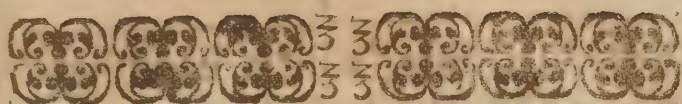
Tours to serve J.W.
D. 1702. 10. 20.

TO

THE HISTORY

of the County of Middlesex
from the earliest times to the
present day. The history of this
county is one of the most
interesting and important in
the country. It is a county of
great antiquity and has been
the seat of many of the most
important events in the history
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the most important events in
the history of the country.



T O

*The Deans and Professors
of the Faculty of Caën.*

S I R S,

TIS usual, when we present
the World with any Work,
to chuse some Worthy Pa-
trons, under whose Name
it may appear, and, who can de-
fend it against the Attacks of En-
vy, Prejudice and Ignorance,
which are three powerful Enimies
to contend against, and such as
cannot be overcome but by those
who have Zeal and Love for Lear-
ning, and which are free and pro-
found in their Understandings.
'Tis

The Epistle

'Tis this, Sirs, which has oblig'd me to offer this little Work to you, and to publish it under the Glory of your Illustrious Society: there are none can more advantageously defend it than your selves, for you disarm Envy by that Zeal and Love which you have alwaies shown to Learning: you vanquish Prejudice by that Liberty and un-interested Disposition which you retain in Physick and Medicine: and you destroy Ignorance by that inexhaustible Fountain of Learning which you enjoy. Wilful Opinion was never known to reign amongst you, for you consider Things with a Solidity and Faculty of Mind truly extraordinary: Reason and Experience are the only Guides you employ in your Inquisitions and Understandings: Authority

Dedictory.

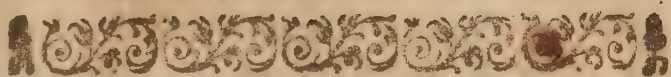
Authority has no place with you if it be not accompanied with solid Reasons, and uncontrollable Experience. In a Word, it seems that Nature cannot withdraw her self from your View, nor hath conceal'd any thing from you.

I had enlarged more in your Commendations did not your Modesty restrain me, and oblige me to make an End: only with protesting my self to be all my life time with Respect,

S I R S,

*Your most humble and
obedient Servant*

F. A.



THE Author's Preface.

WHen I resolved the publishing my Sentiments on Acid and Alkali, I could not but doubt my Book would find some Censurers amongst the greater part of those that should read it: and indeed I had little Reason to expect a more favorable Entertainment for the first production of my Genius; since I have observed the Works of more accomplished and delicate Wits have not escaped the Attaints of Criticks. Besides there is also a particular Consideration which makes me believe, That it is Inevitable to it, since it is not usual to reason according to these Principles which are not yet established. For, it is certain,
That

The P R E F A C E

That there is necessary to the inuring ones self to a New Hypothesis, a certain Measure of Time: for, we see, That such as have at first esteem'd a Doctrine to be Chimerick and vain, have under their Examination, in Order to refute it, found it possible and reasonable at last, and so at length, having made it familiar, have embraced it.

All the Explications which I have made of the more curious Phænomena's of Nature, are so facile and natural, that they are indeed so many Demonstrations of the Truth of these Principles; seeing I have not made use of any other Proof than those which I have drawn from Reason and Experience.

This is that which induced me to Discourse under the Names of Eubulus and Pyrophilus; the first, a man of good

The P R E F A C E.

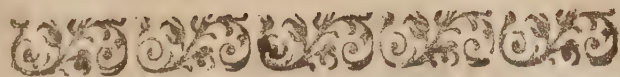
good Understanding; and the other, a Lover of Experiments. I have chose the Form of a Dialogue, believing it most proper to instruct, and to give me room to refute all Objections which should be raised to the contrary, which I have performed with as few words as was possible. I have not sought any vain Ornaments of Language, because it is the Inclination of my Genius to be more intent on the things themselves than in the manner of expressing them: As for the Rest, I desire all those that may happen to have some Experiments come to light, that they cannot explain by these Principles, not to accuse the Hypothesis thereof: But, let such know, That to convince it of Falsity, They ought to demonstrate That it is contrary to Experience; and let them also remember, That others, or even they themselves may, with New Lights one day

The P R E F A C E.

day, discover the true Cause, which they then did not perceive. All those several Operations which I have unfolded hereby shew of what Utility it is in Physicks; and, if what I have said, be so prosperous as to please the Learned, I intend to shew a greater Use thereof in Medicine by the Explication of Diseases, and their Symptoms; and the Remedies we may obtain therefrom, with the manner how they act.

Errata. Pag. 7. l. 4. read but they. p. 9. l. 10. r. Harts-horn. p. 13. l. 8. different. ib. l. 9. -gulations. p. 14. l. 3. a salt. ib. l. 5. dissolve it. p. 50. l. 13. absorbed. p. 56. l. 17. it self. p. 59. l. 9. leaves. p. 63. l. 20. Retine. p. 64. l. 22. Retine. p. 65. l. 16. dele ot. p. 68. l. 11 Retine. p. 72. l. 2. and. ib. l. 20. hath. p. 79. l. 14 or one. p. 99. l. 19. with. p. 101. l. 21. dele the. p. 105. l. 21. dele the. p. 106. l. 10. it. p. 115. l. 1. become. p. 127. l. 15. you have p. 139. l. 16. add one. p. 165. l. 3. be as.

CHYMI-



CHYMICAL
DISCEPTATIONS;

Or, SOME
DISCOURSES
UPON
Acid *and* Alkali.

EUBU-
LUS.

Dear Pyrophilus,
We shall at last
arrive at the

End of our Errors, and Draw
from the Fountain of Nature it
self, Those Necessary Lights
which can make us Philoso-
phers.

PYROPH. What say you, Eu-
bulus?

B

EUB

2 Discourses upon

EUB. I say nothing but what I can convince you of by evident Reason and certain Experiments.

PYR. How have you discovered the Truth?

EUB. The Reading good Authors, and the Converse which I, for some time, have had with learned Men, have quite demolished all my Prejudices, and made me Examine things with as much Freedom and Impartiality, as I had before of Antipathy: I have constantly observed, That Authority, even to this present time, hath been an Invincible Enemy both to Physick and Medicine, and the very Rock upon which all the Famous Men of the past Ages have rely'd; and is indeed, at
this

this day, the Cause of so many Sects and different Opinions which we see in the Schools: Whereas Reason and Experience are the only True KEYS which can give Admittance into either of these Sciences: for, to be a Philosopher, it is absolutely necessary to banish Authority, and to follow Reason and Experience. I am not able sufficiently to admire the prosperous Success and Exactness of the Anatomists and Chymists of our Age! The first having discovered to us, in the Body, Parts, Humours and Uses unknown to the Antients: and the Last have withdrawn us from that erroneous Darkness wherein the Four Elements and their First and Occult Qualities

4 *Discourses upon*

had plunged us, giving us Principles as clear as those were obscure.

PYR. I have alwaies told you That Anatomy and Chymistry were great Assistants to Physick and Medicine, and that they enlighten us much, where we attain it only by their Experiments.

EBU. I do not design to Entertain you here with the New Discoveries of Anatomists upon Humane Bodies : I shall only speak of those which Chymists have made us take Notice of, in the Dissolution of Mixts. Know, that for this Effect, They acknowledg two sorts of Principles; of which, some they call Active Principles; and others they stile Passive

Acid & Alkali. 5

sive Principles. The Active Principles are the Causes of all the Actions and all the different Motions which are done in Nature: The Passive Principles, on the contrary, are not capable of any Action, but serve only as Matrixes to the active Principles for them therein to make their Productions.

PYR. VVe cannot desire an exacter Distinction of Principles, but how many have you of either.

EUB. There is some Controversy amongst Chymists about the Number of Active Principles; Some will have Three, which they call Salt, Sulphur and Mercury; pretending that these are the last Bodies they

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find in the Resolution of Mixts. By Mercury they understand the most subtile, most penetrating and most ætherial Substance in the Mixt. By Sulphur, all that which is therein oleagenous and inflamable: and, By Salt, all that is dissolved in Water, and coagulated by Fire: they say, The Mercury or Spirit is the Soul of Bodies, That it gives Motion and Life to Animals, That it makes Plants grow, brings forth Flowers, and ripens Fruits; also, that it renders Stones and Metals perfect. That the Sulphur or Oil causes the Diversity of Colours and Odors, the Beauty and Deformity of Bodies: and, That the Salt is the cause of the Tastes, Weight, Solidity

Acid & Alkali. 7

ty, and hardness of Mixts. Others acknowledg that there are Salt, Sulphur and Mercury in all Bodies; they demonstrate also by several Experiments, That these Three Substances are composed of Two others, a great deal more simple, viz. of Acid and Alkali Salts, and that Salt, Sulphur and Mercury are no other but these Two Salts at liberty or intangl'd: In effect, you shall observe, That there are Two sorts of Salts, there are some Simples, which are not compounded of any other Substance; and some Compounds (as are all the compound Mineral Salts, and essential Salts of Plants) which are composed of simple Salts and passive Principles, notwithstanding in

but

8 *Discourses upon*

such sort as the Acid, which is the first of these simple Salts, predominates therein. And these Salts are called Salts, because they are dissolved by Moisture, and coagulated by Dri-
ness.

The simple Salts are either Alkali or Acid; the Alkali Salts are either Fixed or Volatile: the Acid Salts are alwaies in a Liquor; therefore called Acid Spirits: nevertheless, these Acid Spirits are no other but Acid Salts dissolved in a little water. The Alkali Salt, on the contrary, is almost alwaies in a Body: it is, as I said but even now, either fixed or volatile: the fixed Alkali Salt is never elevated by the action of Fire, as Salt of Tartar, and
all

Acid & Alkali. 9

all those Salts which are drawn from Plants by Incineration, which we call Lixivate Salts, as those of Scordium, Tamarisk, &c. The Volatile Alkali Salt, on the contrary, is elevated with the least heat of fire, and is drawn chiefly from Animals, as the Volatile Salt of Vipers, Harts, ^{and} *Man* &c.

There are Three Sorts of Mercury or Spirit; an Acid Spirit, as that of Niter, Allum, Vitriol, &c. A sharp or biting Spirit, as that of Harts-horn, Urine, Vipers, &c. and a burning Spirit, as that of Wine, Beer, Cyder, &c. The Acid Spirit is an Acid Salt dissolved in a little Flegm: The sharp biting Spirit is an Alkali, volatile likewise, dissolved in a little Flegm,

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Flegm, and the burning Spirit is a Sulphur; and a Sulphur is an enveloped Acid.

All Chymists, in effect, agree That there are two passive Principles, viz. Water and Earth, or Flegm and Caput Mort.

The Water serves as a Menstruum and Dissolvent to the Acid and Alkali Salts; and it is extracted by Distillation from those Bodies which contain it.

The Earth serves as a Bond to these Two Salts, it is extracted commonly after the Extraction of the Lixivious Salt.

It is to be noted, That according to the different Mixture of these Four sorts of Substances, and the different Rangings of their Parts, there are made different Productions in Nature,
some;

Acid & Alkali. II

Sometimes of Animals, sometimes of Vegetables, and sometimes of Minerals.

PYR What do you mean by Acid Salt and Alkali Salt?

EUB The Acid Salt is easily known by the Taste and Smell, and by the Fermentation which it makes with Alkali's, as Spirit of Sulphur. This Salt is composed of small sharp pointed parts, which insinuate themselves into the Pores of those Bodies they meet with, and make either a Dis-union of their Parts, or a Coagulation: for, according to the different Motions, particular Figure, Subtily or Grosness of these Points and the disposition of those Bodies, they either pass through them with Violence, and scatter

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ter their parts one from another: or else they are Entangled therein, in such sort that they lose their Force and their Motion in them: Remaining very often sticking to them.

We observe, in effect, That Acid Salts dissolve hard Bodies, as Stones, and Metals, (except Gold, which cannot be dissolv'd but in salt Menstruums :) and coagulates the most part of soft and fluid Bodies, such as Milk, Blood, &c.

PYR. Then, there are Acid Salts of different Natures?

EUB. There are as many different sorts of Acid salts as there are different Bodies in Nature; and though the Particles or Atoms which compose them are all sharp, yet that hinders not.

Acid & Alkali. 13

not, but they have nevertheless all different Figures, which causes all the compound Mineral Salts, in which the Acid salt predominates, as Niter, Vitriol, &c. and also the Essential Salts of Plants, to take all different Figures in their Coagulations according to the Nature of the Acid which determines them, whence some are formed Pyramidical, as Niter; others, winding like a Screw, as Vitriol, &c.

PYR. Whence comes it, That Acids dissolve Silver and other Metals, and do not dissolve Gold? and, on the contrary, salt Liquors dissolve Gold, and touch neither Silver nor other Metals?

EUB. Gold being almost all Sulphur,

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it

Sulphur, cannot be corroded by Acids of what nature soever they be, it must be salt Liquor, and as perfect a Spirit of Salt as can dissolve it, which in Corrosion must re-take the Nature of Salt: Silver and other Metalls having, on the contrary, more Mercury than Sulphur, can never be dissolved in salt Menstruums, for there is none but Acid Spirits that can dissolve them. To confirm both to you, You ought to take Notice, That those that work in Salt Petre after they have extracted it draw forth yet a Salt, a great deal less acid; which is of the Nature of common salt, which they call Sal centrique, which when it is Resolved into a Liquor dissolves Gold after the same

sal Contr
iquor

Acid & Alkali. 15

same Manner as Spirit of Salt doth, and in corroding re-takes the Nature of Salt, and dissolves neither Silver nor other Metals.

PYR. Suppose that Gold be almost all Sulphur, and then it is easy to comprehend, Why it cannot be dissolved by Acids, but only by salt Menstruums.

EUB. Have you never observed, That when Gold is in flux, if the end of an iron Rod be put therein, it will be calcined and reduced into Scoria? after the same manner as if it had been burnt with common Sulphur: and, that Argent vive forsakes all Metals to join it self with Gold, which it renders as brittle as Glass: How should Gold calcine Iron, and be in such wise
pene-

16 *Discourses upon*

penetrated by Mercury, as to become brittle as Glass, if it did not abound with Sulphur? first you know, That Iron can't be calcin'd but by Sulphur, which seeing Gold calcines, consequently Gold must be a Sulphur. Secondly, Mercury being a powerful Metallick Alkali (though imprisoned) which is not joined but with a Sulphur of its own Nature, would not quit other Metals to be joined to Gold, if Gold had not more Sulphur than others: and the Mercury renders it not otherwise brittle, but because it absorbs its Sulphur and disunites the parts thereof.

PYR. Mercury, nevertheless, does not destroy the Body of Gold, which it would do, if it
absorbe

Acid & Alkali. 17

absorbed the Sulphur, and dis-
united the parts thereof.

EUB. That is not a Conse-
quence, That because the Mer-
cury absorbed the Sulphur of
Gold, and scattered the parts
thereof, It must therefore de-
stroy it; for the Sulphur of
Gold being most fixed, and the
Mercury, on the contrary, be-
ing most volatile, there cannot
be made an exact Union betwixt
them two, that is to say, by
small parts; and, the Mercury
being cast into the fire, quits in
that moment the Sulphur of
the Gold which it had absor-
bed, and flies away, and the
Sulphur of the Gold is re-uni-
ted to its own Mercury, and the
Gold becomes as hard, as fixed
and as solid as it was before:

C

more

18 Discourses upon

Moreover, how should Gold become fulminant, if it did not abound in Sulphur? The composition of Aurum fulminans makes us sufficiently sensible of it. They cause Gold to dissolve in Aqua Regis, which they afterwards precipitate by little and little with Oil of Tartar made per Deliquium: there is then made a Union of the Alkali of Tartar with the Acid Spirit of the Nitar, which composed the Aqua fort; and there is produced therefrom a new-made Nitar: this Nitar, being united to the Sulphur of the Gold, is inflamed, and produceth all those surprizing Effects which we take Notice of therein.

FYR. The Nitar would Produce

Acid & Alkali. 19

duce these Effects alone, or being mingled with the Sal Armoniack or common Salt, which was put into the Aqua Regia.

EUB. Salt-Petar is never inflamed but when it is mingled with some Sulphur; as with common Sulphur in Gun-powder and Pulvis fulminans; or with the Sulphur of Antimony when one makes Regulus and Liver, &c. Common salt and Sal Armoniack are so far from rend'ring Salt-Petar inflamable, that they extinguish fire with more force than common Water doth: it therefore follows, That the Sulphur of the Gold is united with the Salt-Petar, and causes this Deflagration.

PYR. We see nevertheless, That Salt-Petar is inflamed at

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the same time that one puts it on burning Coals.

EUB. The Salt Petar is not inflamed then, but because it is united to the Sulphur of the Coals: for if one put some Salt-Petar into a Crucible and make the Crucible red-hot, it simply melts, and is not inflamed but when one casts some Sulphur or some Coal thereinto.

And, to convince you fully, That Gold contains a great deal more Sulphur than other Metals; You may take Notice, That one cannot make either Silver, Lead or Tin fulminant, because These Metals have only a very little Sulphur, which is wholly absorbed by their Mercury.

There is nothing in the world

Acid & Alkali. 21

world which owes not its Birth to Acid Salt: nothing can live, nor be multiplied without it: It is that Soul of the World, of which the Antients have so often told us:

*Spiritus intus alit, totamq; infusa
per artus*

Mens agitat Molem.

The Spirit within, and the Mind infused, through the Members nourisheth and agitates the whole Body.

In a word, The Acid Salt is the Author of the Construction of every Body, and the absolute Master of Alkali Salts, it prints them (as a Seal is made on Wax) with all sorts of Characters, and makes thereof several different Bodies, accord-

22 *Discourses upon*

ing to the diversity of its points, as we observe by the Regeneration of the Essential Salts of Plants, and compound Mineral Salts.

If one mingles with an Alkali, either fixed or volatile, the Acid Liquor of some Vegetable: as for example, Of the grains of Kermes, or Wine, 'till there is not made any more Fermentation, and then one philters them through grey Paper, and evaporates the superfluous humidity, causing them to cristallize in a Cellar or some other cool place: there will be made thereof an essential Salt of Kermes, which hath the same Virtues with that which is ordinarily drawn. There will also be made a Tartar like that of

Wine

Acid & Alkali. 23

Wine, whose sourness is gone.

The Acid Spirits of compound Mineral Salts, as of Alum, Niter, &c. change all sorts of Alkali's into Salts of their own nature, to wit, into Alum, Niter, &c. like to those from which they were drawn.

PYR. These Experiments are most fine, most curious and most convincing, & this new way of Reasoning by Deeds, please me much. but pray give me as clear an Idea of Alkali Salt, as this you have giv'n me of Acid Salt.

EUB. The Alkali salt is easily known, by its fermentation with Acids, and by its precipitating Vitriol of Mars, and other compound Mineral Salts dissolved in water, except Sea salt, in which, the Acid and

C 4

Alkali

24 *Discourses upon*

Alkali are so strictly united that neither the violence of fire, nor the mixture of any other Body can ever dis-unite them, as I have already said, where I spoke of the Dissolution of Gold in salt Menstruums. I have caused you to take Notice, That there are two sorts of Alkali's, a fixed and a volatile; fixed, as Salt of Tartar: Volatile, as the volatile Salt of Vipers.

Sal Alkali is extremely porous, wholly empty and rough, that is to say, whose parts are unequal: and, 'tis for this Reason, That it whitens Linnen, and cleanseth Stuffs: It takes out the Filths that are found therein by its Inequalities, and it fills at length its pores therewith.

PYR.

Acid & Alkali. 25

PYR. What Proofs have you
That Sal Alkali is vacuous and
cleanses Linnen and Stuffs

EUB. There are several Ex-
periments which proove both.
If Alkali's were not vacuous
Salts, How should they be so
easily resolved into a Liquor,
when they are put into a moist
place? since 'tis observed that
Salts filled with their Acids, as
Niter, Alumn, Vitriol, &c. are
not Dissolv'd therein; the Al-
kali of Niter, which has not
been separated from its Caput
Mort; could not charge it self
with an Acid equal to that
which was drawn therefrom:
Diaphoretick Antimony which
has not yet been washed, should
not augment Weight therein, and
should not change its Diapho-
retick

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retick quality into an Emetick: in a word, Corals, Lead, and divers other Alkali's reverberated in a violent fire during some daies and nights, should not augment a fifth part; and of Alkali's as they were, should not become salt, and should ferment still with Acids, as they did before, if Alkali's were not vacuous salts, which are easily filled with the Acids of the air and fire. We see, notwithstanding all these Experiments are true: that the Alkali of Nitar draws out of the Air an Acid of its own Nature, That Antimonium Diaphoreticum becomes therein Emetick: that reverberated Corals augment not only in weight, but also become Salt, and ferment no more with
Acids,

Acid & Alkali. 27

Acids, from whence we may very justly conclude, That Alkali Salts are vacuous and porous Salts, which fill themselves with all sorts of Acids, of what nature soever they may be.

There are also no less Proofs that Sal Alkali whitens Linnen and cleanseth stuffs: if you have observed, that one cannot make a Lixivium of ashes wherein this salt is wanting, as it is in those of Wood, which hath a long time floated, but only of those in which it abounds, as in the ashes of Oaks, Apple-tree, Broom, &c. and, That the salt Salts, as common Salt, can never cleanse them, because that their Alkali is wholly filled with its Acid, and so consequently

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sequently it cannot fill it self with the filths of the Linnen and Stuffs: I should have no need to bring any other proofs, nor to tell you, That the herb which we call *Saponaire* [Soapwort] because it is made use of to whiten Linnen and Stuffs, cleanses them on no other account, but because it abounds in this Salt.

PYR. I am sufficiently convinced by what you have told me. You have already explain'd (where you spoke of the Dissolution of Metals) why Gold cannot be dissolved but by a Salt Liquor, and Silver and the other Metals, on the contrary, but by an Acid Liquor: I would willingly you Explained to me, Why Acids do not precipitate
Vitri-

Acid & Alkali. 29

Vitriol of Mars dissolv'd in water, as Alkali's do: and, as they, on the contrary, precipitate equal with them, Mercury sublimate dissolved in common water, & ☿ dissolv'd in Aq. fort.

EUB. It is easy to give you a Reason for all these different Effects: for, Little do you consider the manner by which these Præcipitations are performed. Alkali's, as well fixed as volatile precipitate all these Dissolutions, because they absorb the Acids which hold the Iron and Mercury in Dissolution; and in this Manner the Iron and the Mercury being no longer detained nor agitated by the points of those Acids, are precipitated and fall by their own weight to the bottom of the Vessel which

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which contains them : It happens much otherwise in the precipitation which Acids make of corrosive sublimate dissolv'd in common Water, and Mercury dissolved in Aqua fort. for there is not made any Union of Acid with Alkali, but only a Confusion of Acid with Acid : and this precipitation happens only because the Acids of Niter, Vitriol and common salt which had sublimed the Mercury, and those of the Aqua fort. which had dissolv'd it, were not able to penetrate, nor unite themselves intimately with it : which causes that a new Acid easily shakes them & makes them at the same time to quit their hold ; thus is the γ precipitated : This is the Reason

Acid & Alkali. 31

son why Acids can never precipitate Vitriol of Mars dissolv'd in water, because there is so perfect and strict a Union between its Acid and Alkali, that there is not found the least pore which is not filled, in such manner, That a New Acid not finding therein any vacuous place can never dis-unite them.

PYR. I do not yet well understand how Acids which hold a Body in Dissolution, can quit it to join themselves to another.

EUB. Experience will presently make you comprehend it, for if one casts upon a Solution of Vitriol of Mars and upon that of Mercury sublimate an Alkali, whatsoever it be, there will be made at that instant a Precipitate: and, if after ha-
ving

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ving put an Alkali to it, there is immediately put an Acid, there will not be made any precipitate, but the solution will remain as clear as it was before; because the Acid which was put last thereto, joining it self to the Alkali which was put to it before, hinders consequently that that Alkali cannot absorb the Acid which held the Mercury and Iron in dissolution: if this Precipitation of Vitriol or Mars, and Mercury dissolved by Acid Spirits and precipitated afterwards with Alkali's, was made after any other manner than that which I have already told you, it should be all one whether one put an Acid thereto after there was an Alkali cast into it; or, that

that one put none, the which notwithstanding happens not, for the Acid which was put thereto, joining it self to the Alkali which was put thereto before, hinders by that means that the Alkali could not absorb the Acid spirits, which held the Mercury and Iron in dissolution.

PYR. All your Experiments convince me strongly of that which you have told me concerning Acid and Alkali Salts; but, as it is not sufficient to Establish Principles, only to tell what they are, and what they do : It is therefore very needful it be prov'd that they Exist, that they are found in all Bodies, and that they are Principles therto, that's to say,

D That

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That all Bodies are resolv'd into them; and, that they are not resolv'd into any other substance: and, 'Tis this that I could wish you would plainly shew me, concerning these two Salts, if it be possible.

EUB. You have none but Animals, Vegetables and Minerals to examine, and you shall not find one of them, in which these two Salts are not to be met withal, and in which they are not Principles.

The Volatile Alkali's which are drawn in abundance from the Blood, Flesh, Horns and Bones of Animals, which ferments with all Acids, and precipitates Vitriol of Mars dissolved in water, do they not prove, There is excess of Alkali therein?

Acid & Alkali. 35

therein? and the different Acid Juices which are separated from their Bodies, as Spittle which mortifies Mercury, it being a powerful Alkali, which cannot be so mortified but by an Acid: and, as the Acid of the Stomach curdles Milk when one drinks it fasting, the which is plainly perceived by Vomiting it up again, almost as soon as it was taken, and Milk cannot be coagulated but by an Acid. Flesh, also Blood and Milk which grow sower when they begin to corrupt, prove sufficiently, That there is some Acid Salt in Animals.

Is there a Vegetable in which these two Salts are not found? the simple Fermentation which Vegetable Juices make, should

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be

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be sufficient to convince you of it ; for Fermentation, as I shall tell you hereafter, cannot be made but by the meeting of these two Salts. Also there is not a Vegetable from which we do not draw a great quantity of Alkali, and which does not give, when it begins to corrupt sufficiently sensible signs of its Acidity. How also should we be able to draw an Essential Salt from Plants, if they had not Acid and Alkali, seeing Essential salts are no other (as I gave you to observe, when I spake of the Regeneration of Salts) than these two Salts joined together.

Do they not draw also an Acid and Alkali from Minerals? compound Mineral Salts, as Vitriol,

Acid & Alkali. 37

triol, Alum, Niter, &c. give us an Acid in dissolution; and leave us an Alkali in the Caput Mort. Calcined stones, as Calx vive, are not fermented when they are dissolved in water; but because they contain each of these two Salts: Hath not common Sulphur its Acid, which they draw, per Campanum, in burning it, and which elevates Mercury into Cinaber? hath it not also its Alkali which remains in the Caput Mort? Is there not Acid and Alkali in Antimony, as we observe in the Composition of its Butter? Equal parts of Antimony and Mercury sublimate they mingle together, which they put in a Retort and commit to the fire. Then the Acid spirits.

D 3 which

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which had sublimed the Mercury, quits it to join it self to the mercurial Part or Alkali of the Antimony, and the Sulphur or Acid of the Antimony elevates the Mercury into Cinnabar. Have not the Metals also their Acid and Alkali? Gold abounds in Sulphur which is Acid, and it hath a Mercury which retains this Sulphur, and unites it self intimately to it, Silver and the other Metals have a Mercury which ferments with spirit of Niter which is Acid and a Sulphur which hinders the volatility, and fluidity of this Mercury.

PYR. May not the fire produce these Salts also from the most part of those Bodies from which

Acid & Alkali. 39

which they are drawn.

EUB. No ; for when one has once drawn the Salt from Ashes, calcine them never so well, they will never give others, no more than floted wood [that is. I suppose, Wood that has lain in water till it is rotten] rotten wood, and Plants exposed some daies and nights to the Aier, because their salts have been dissolv'd in the air and water, and are consequently drawn out from their Bodies. It should not happen so, if the fire had produced those two Salts ; for, then at all times, whether after Putrification or Calcination the fire should always, produce some new salt, and one body would give no more than another ; the which

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is contrary to Experience, as you see.

The Acidity of Blood, Milk and Flesh is natural to them, and those different Acid Juices which we find in the Bodies of Animals are separated therefrom without Artifice, and without the help of fire.

The Fermentation which Vegetable Juices make, is done of it self.

In a word; The Acids and Alkali's of compound Mineral salts, separated one from the other by the means of fire, would never recompose the same salts, when one reunites them together, if the Fire had produced them: for, what proportion, what relation should these new Productions of the
fire

Acid & Alkali. 41

fire have with the Principles which compose these salts, to cause that these Productions should regenerate salts, as natural as Niter, Alum, Sal-gem, &c.

You see plainly by all these Experiments, That the Fire does not produce in Bodies the Salts which we draw therefrom, but that these Salts are actually found therein. There remains no more, but that I shew you they are Principles thereto.

There are commonly drawn from all Bodies, three different Substances, to which are given (as I have already said) the names of Salt, Sulphur and Mercury, which are pretended to be the last Bodies, which are found

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found in the Resolution off Mixts: but Experience hath at length discovered, That these Three Substances were composed of Acid Salt and Alkali Salt; and, that these two Salts are not composed of any other substance, and by consequence, they ought to be Principles.

For, though the Artift works as much as he will, he may easily find the means to reduce the Salt, Sulphur and Mercury into our Two Salts. but he will never find the Knack to reduce these two Salts into any other Substances; and though he make use of the same two Instruments which he used for the reducing the other Three substances into these Two Salts, to wit, Fire and Water: notwithstanding

Acid & Alkali. 43

standing he shall never be able to make that the Acid Salt be no more Acid Salt, nor the Alkali Salt, Sal Alkali.

I have occasioned you to take Notice, that there are two sorts of Salts, namely, an Acid Salt and an Alkali; That there are Three sorts of Spirits or Mercuries, an Acid spirit, a sharp [biting] spirit, and a burning spirit: that the Acid spirit was an Acid Salt, dissolv'd in a little flegm; the sharp spirit a volatile Alkali dissolved also in a little flegm; and the burning spirit, a Sulphur, and Sulphur an enveloped Acid. I have now no more to do, but to bring you some Experiments to convince you of this Truth.

I. EX-

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I. EXPERIMENT.

*Which proves that Acid Spirits
are no other than Acid Salts
dissolved in some flegm.*

An Acid Spirit ferments it
self with all Alkali's, and makes
thereof Salts of the same na-
ture with those from which it
was drawn, as the Spirit of Ni-
ter, &c.

II. EXPERIMENT.

*A sharp Spirit is a Volatile Alkali
dissolved in some Flegm.*

All sharp spirits ferment
themselves with Acids, and
precipitates Vitriol of Mars
dis;

Acid & Alkali. 45

dissolved in water, as the volatile spirit of sal-Armoniack, &c.

III. EXPERIMENT

*Which proves that burning spirits
are Sulphurs.*

Plants give a great deal of Oil, and a little spirit, before they are fermented: and they give, on the contrary, a great deal of spirit, and a very little Oil after they are fermented, because the parts thereof unloose themselves and dis-intangle themselves one from the other in the time of Fermentation, and remain bound and intangled one in the other before the Fermentation was made, which clearly shews that

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a burning spirit is a vegetable sulphur, but much less intangled than the other sulphurs of Vegetables.

IV. EXPERIMENT

Which proves the same.

Experience shews us, That burning spirits exposed to the air for some time, are changed into Oils of the same nature as those of the Plants from which they were drawn.

V. EXPERIMENT

Which demonstrates that burning Spirits are enveloped Acids.

There is drawn from salt

oil

Acid & Alkali. 47

of Saturn a burning spirit of the same nature as spirit of Wine, this spirit cannot come but from the Acid of the distilled Vinegar, which entred into the Composition of the salt of Saturn, whose parts are bound and intangled one in the other.

VI. EXPERIMENT

Which proves that Oyles of Vegetables are enveloped Acids.

Oyl corrodes Copper and turns it into Verdigrise: there are none but Acids which can produce this Effect: and therefore consequently Oil ought to be Acid.

VII.

VII. EXPERIMENT

Which proves the same.

Fire is an Oyl whose parts are unwrapped, and in a most Violent Agitation and Motion: fire is Acid, (since it renders Corals Salt) Oyl which is the matter thereof ought then to be Acid.

VIII. EXPERIMENT

Which proves the same.

Soap does furnish us still with a most convincing Proof, That Oils of Vegetables are enveloped Acids: Soap is made with three parts of Alkali and

two

Acid & Alkali. 49

two of Oil, which two matters are mingled together, and then boiled; and there comes therefrom a salt body which is Soap: you know that saltness comes from the mixture of Acid with Alkali: and, that consequently, seeing soap is salt, the Soap ought not only to have Alkali in it, but also Acid, the Acid cannot be communicated to it but by the Oil which was put thereto, which Acid unwraps it self in the Alkali, which was joined thereto: it must be therefore that Oil is an enveiled Acid.

PYR. It may be also, That the Fire communicated this saltness to the soap, as it did to the Corals; for, you have already told me, That when one

E

re

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reverberates them in a violent fire for some daies and nights, they become intirely Salt, and ferment no more with Acids.

EUB. The same thing cannot be said of soap, as of Corals; because one must reverberate the Coral six daies and nights to render them salt, and the saltness of Soap is communicated to it in a short time, even as soon as the Acid of the Oil is dis-enveloped and ~~absorbed~~ *absorbed* by the Alkali which was put thereto, likewise the soap augments not in weight on the fire, as the Corals do, they augmenting a fifth part.

IX. EXPERIMENT,

*Which proves that the Fats and
Suets of Animals are enveloped
Acids.*

Soap is made with the suct
of Animals, after the same man-
ner as it is with the Oils of Ve-
getables : It must be therefore
that the Fats and Suets of Ani-
mals may be enveloped Acids;
as the Oils of Vegetables are.

X. EXPERIMENT,

Which proves the same.

The flame of Fats and Suets
is Acid : it destroys Iron, and
reduces it into Scoria's, &c.

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Greases

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Grease's and Suets ought then
to be Acids.

XI. EXPERIMENT,

*Which proves that the Sulphars of
Minerals and Metals are envel-
oped Acids.*

Sulphur of Antimony ele-
vates Mercury into Cinnabar,
as we observed in the Composi-
tion of its Butter; How shou'd
the Sulphur of Antimony ele-
vate Mercury (which is an Al-
kali) into Cinnabar, if it were
not Acid? It follows therefore
that the Sulphur of Antimony
is acid.

Common Sulphur elevates
Mercury into Cinnabar, and it
may be made use of for the
com-

Acid & Alkali. 53

position of Soap, as well as the Oils of Vegetables, and Fats of Animals: In a word, the Sulphur of Gold is acid, since it produceth the same Effects as Acids do, for it calcines Iron which cannot be calcin'd but by Acids, &c. The Sulphurs of Minerals and Metals are then enveloped Acids.

PYR. In Truth, These Principles are most sensible and palpable.

EUB. This is not yet enough to have discovered thus much to you concerning Acid Salt & Alkali Salt in particular: but 'tis needful that I press the thing more home, and that I make you know what these II Salts are capable to do, when they are once united. These

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verho surd ~ well what much
ey p. m 54 Discourses upon
indigen

{two Salts are in regard one of the other, as the Soul is in regard of the Body, and the Body in respect of the Soul: The ~~the~~ Acid Salt is the Soul which animates and vivifies the Body, and the Alkali Salt is the Body which receiveth the Soul and unites it self so intimately therewith: that this Soul can be nothing without this Body, nor this Body without this Soul. When they are once intimately united, as we observe in common Salt: it is impossible to separate them one from the other: and though these two Salts seem, at first sight, to have an Antipathy, one against the other, by the Fermentation which they make when they meet: Nevertheless they em-

Acid & Alkali. 55

embrace and unite in such wise together, that, very far from destroying themselves, they are coagulated, and make no more, but one and the same Body. And, it may be said thereof as the Incomparable *Hypocrates* hath said in his Book of *DIE T*, speaking of Fire and Water, that though these two Elements differ in Quality, nevertheless, they agree in use, That they are sufficient for all Bodies and for themselves, but neither the one nor the other separated can be sufficient neither for any other body nor for it self.

Constituuntur (saith he) tum Animalia tum alia omnia, tum homo ipse ex duobus differentiibus quidem facultate, Concordibus vero &

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commodis usu; hæc ambo simul sufficientia sunt tum aliis omnibus, tum mutuo sibi ipsis, Utrumvis vero seorsum neque ulli alteri neque sibi ipsi sufficiens est.

All living creatures (saith he) as well all other things as Man himself, are constituted of two Principles different in Faculty, but concurring and fit for use: These two together are sufficient for all other things, as well as for themselves, but either of them severally and apart is neither sufficient for any other nor for ~~themselves~~ *it self*

These two Salts are never at rest, if they be not united one with the other, and as soon as they are once united, have nothing but love and sympathy

one

Acid & Alkali. 57

one for the other : which we take notice of by an Infinity of Experiments, as by the sympathetical Inks.

The first Sympathetical Ink.

Here must be made two different Liquors in two separate Vessels,

The first, which is that we must write with, is made with distilled Vinegar and Ceruse, which must be made to boil together for the space of an hour in a well stoppt Vial, then filter them through grey Paper, and reserve the Liquor which comes therefrom in another bottle well stoppt.

The Second which causeth the writing to appear, is made with

*Lemon
spirit
Sensitized
c. colors
in Juice
of B. or
any
other
24*

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with Calx Vive, Orpiment and common water, after the same manner as the former.

We Write with the first of these two Liquors, and we apply upon the Writing a paper imbued with the last; the Writing that was invisible appears at that instant as black as if it had been writ with the best Ink in the world.

For to understand clearly the cause of this so surprising Effect, we must take Notice, That the Calx vive and Orpiment are bound with Alkali, and that these Alkali's wherewith we did imbue the Paper, quits the Paper to absorb the Acid of the Vinegar, and so the Writing appears.

But that which is more surprising

Acid & Alkali. 59

prising is, That the Alkali's of Calx Vive and Orpiment can pass through a Ream of Paper, a Table, and a Wall, to absorb the Acids of the Vinegar, which is observed by the Writing which at the same time appears, and by the Impression and odour which it leaves on the Paper.

The Second Sympathetical Ink.

WE must write with an Ink made of Cork Coals and Gum-Arabick, and the Writing will appear most black; then rub this Writing with the Liquor made with the Calx Vive and Orpiment, and it will at that instant disappear, and will never reappear, if it be not rubbed

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bed with some acid liquor, as with that which was made with distilled Vinegar and Ceruse.

The Alkali's of Calx Vive, and Orpiment absorb (as you see) the Acid of the Cork Coals and Gum Arabick, and so obliterate the Writing, which reappears as soon as it is rub'd with some Acid liquor, because the Alkali which had absorbed the Acid of the Ink, quits it to absorb that which one casts thereto : thus the Writing reappears.

The Third Sympathetical Ink.

THIS third Experiment teacheth the way to transcribe in a Moment all sort of Books and

Acid & Alkali. 61

and Characters, and to draw out all sorts of Prints.

Take Venice Soap cut into little bits, and Oak-ashes equal parts, and about as much Calx vive, cause them to boil in a new bottle with common water, then philter them through grey Paper, and rub with a feather dipt in the Liquor which shall come therefrom the Book or Image which you would draw, put some white Paper which you shal also rub with the said Liquor, between each leaf of the Book; put this Book between two pressures, & in a quarter of an hour it will be drawn; the Letters or Picture not being in any wise hurt.

The Reason of this Experiment is, That the Acid of the
Ink

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Ink, which always over-powers its Alkali, and which in process of time blots out the print or writing, does fortify the Acid of the Liquor, where-with we did imbue the Paper, in uniting it self with its Alkali, and consequently prints all the Characters of the Book on the Paper, after such fashion as they are in the book printed or written, only as much Acid as the Alkali thereof could absorb; so that the writing becomes fairer and neater than it was before.

It is for the same Reason that Acids, as spirit of Niter, obliterates writing, because they choke the Alkali thereof; and, that strong Alkali's, such as the Infusion of Gall-nuts, causes

Acid & Alkali. 63

causes them to reappear when they are rub'd therewith, and renews antient defaced Books and Writings, because they charge themselves with the Acid which had blotted out the Writing.

These two Salts are at rest as soon as they are united: they cause the Diversities of all the Phenomena's which we see in Nature. They are the cause of the permanent color, which we behold, and of the Odours we scent, and Savors which we perceive, for, according to the different Mixture of these two Salts, the different Nature and the different Ranging of their parts, the ~~Retain~~ is differently struck, and we behold different Colours, and the olfactory Nerves & papillous Nerves

Retina

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of the Tongue are also differently struck, and we taste, and smell differently.

PYR. I earnestly desire you would yet more explain to me: how Acid Salt and Alkali Salt joined together cause in us all these different Sentiments of which you tell us.

EUB. Whether the diversity of Colors which we behold comes only from the divers Reflection of the Light; whether they come only from the different Impression which a coloured Body makes upon the Air, and the Air upon the optick Nerves: or, whether lastly, they may be no other but Atoms or Corpuscles which go out continually from Bodies, and striking

Retina the Retain, cause in us different

Acid & Alkali. 65

colours; it's alwaies constant,
That the principal cause of
permanent colours comes only
from the different Nature, and
different Mixture of Acid Salts
with Alkali Salts, which we
may observe by divers Experi-
ments.

The first Experiment.

ALL Acids destroy blew co-
lours, and all Alkali's make
them re-appear.

The Second Experiment.

SYRUP of Violets, which is a
Composition of Acid and
Alkali, becoms ~~of~~ the fairest
Green in the world when it is
mingled with some Alkali, as
F. with

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with oil of Tartar made *per deliquium* ; and reddish, when some Acid is mingled therewith.

The Third Experiment.

Oil of Vitriol is a powerful Acid, makes a black Composition with an Infusion of Gall-nuts which is a powerful Alkali.

The Fourth Experiment.

A Decoction of Red Roses becomes ruddy by Mixture with Acids, and black by Mixture with Alkali's.

The

The Fifth Experiment.

Mercury is elevated into Cinabar by common Sulphur and becomes a fair Red : and the same Mercury sublimed, dissolv'd in water, and then precipitated by Alkali's, falls down in a powder, sometimes red, sometimes white, yellow, citrine, &c. according to the nature of the Alkali which precipitated it, and as the Alkali absorbed more or less the Acid which held the Mercury in Dissolution.

The Sixth Experiment.

Spirit of Niter, which is a great Acid, renders the Jui-

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ces of Herbs, which abound in volatile Alkali, as white as Milk.

Distilled Vinegar doth the same with Litharge in the Composition of Lac Virginis.

The Smell is an affection of the olfactory Nerves, and the Taste is also one of the papillous Nerves of the Tongue, as co-
Relation ~~ours~~ are of the Retain. There is so great a Relation between the Taste and Smell, that those things which are agreeable to the Smell are also almost alwayes to the Taste: Whence it comes, That the most part of Animals smell their Aliments before they tast them, and they do not eat them except they find them agreeable to their Smell, as we may take notice
of

Acid & Alkali. 69

of it in Apes. All the Difference between these two Senses is, That the Particles which cause us to Smell are a great deal more subtile and thin than those which cause us to Taste.

As there are no Colors which we do not behold but by the different mixtures of Acids with Alkali's; so there is also no Savour nor Odors which we do not perceive according to the divers Mixture of these two Salts.

I. EXPERIMENT,

Which proves that Odours come from Acid and Alkali.

Oil of Roses drawn by Distillation (which is an enveloped

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enveloped Acid) mixt with a sufficient great quantity of water hath almost no odour, but mingled with Salt of Tartar, which is a powerful Alkali, it makes a fluid Composition, some drops of which being mingled with a quantity of water, makes the water one of the most delightful odours in the World.

2. EXPERIMENT,

Which proves the same.

Sulphurs of Minerals which are enveloped Acids, being to be dissolved by Fire, or some other Dissolvent, cast forth an odour as stinking as that of the Oil of Roses drawn by Distillation, but mixt with some Alkali it's pleasant.

Acid & Alkali. 71

3. EXPERIMENT.

*Which proves that the Difference
of Tasts comes from the Diver-
sity of Acids and Alkali's.*

EXperience shews us, That
Saltness comes from the
Mixture of Acids with Alka-
li's: Soap which is salt gives
us a familiar example thereof;
It is made with pure Alkali's,
and Oil which is an enveloped
Acid.

4. EXPERIMENT.

*Which proves that the Diversi-
ty of Savours depends upon the*
F 4 *disfe.*

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*different Mixture and particular
nature of Acids ~~with~~ Alkali's.*
and

Silver reduced into Crystals by spirit of Niter, which is a powerful Acid, become of an extream bitter Tast: Lead, on the contrary, dissolved in distilled Vinegar and reduced into salt, acquires the sweetness of sugar, &c.

I could bring several other Experiments to prove that the diversity of Odors and Savours depends upon the different Mixture of Acid and Alkali: But, tho' I have discoursed you thereof elsewhere, I shall yet bring you one more sufficiently familiar: which is that of *Rath* Wine: Wine ~~having~~ another Tast and another Smell before it

Acid & Alkali. 73

It is fermented, than it has when it is fermenting. or after it is fermented, for it changes by little and little its green taste into a plesanter, and becomes at last sour, and loseth its temperament of Wine; and all these changes happens to it according to the Acids and Alkalies which are found therein are more or less intangled, and as one of them is more or less exalted, and there is almost no odor or savor through which it doth not pass before it grows sour.

There remains no more but that I speak two words of the passive Principles.

The Water is the first of these Principles, it serves (as I have

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have already told you) as a Vehicle to the Acid and Alkali salts ; it serves also to dissolve them, and put them in Motion because Salts act not except they are dissolved, *Salia non agunt nisi dissoluta.*

Water causes the Destruction of Mixts, when it is found therein in too great a quantity, as it compacts them; and strictly unites their parts when it is found therein in a lesser quantity; and it fills up the empty spaces, which it meets with therein.

The Earth or Caput Mortuum on the contrary being extremely porous and light makes a great many vacancies in Bodies wherein it is found but, on the other hand, it hinders

dem

Acid & Alkali. 75

ders that those bodies be not
destroy'd by the abundance of
Flegm.

It is unnecessary to bring you
a great many Experiments to
prove that Water and Earth are
found in all Bodies, and, That
they are Principles thereto, but
without any action: I believe
you are sufficiently convinced
thereof, and have several times
observ'd, That there is no Bo-
dy from which we cannot draw
some Flegm by Distillation, and
which leave not some Earth
after Calcination; and though
we work never so much on Wa-
ter and Earth, it is Impossi-
ble to draw any other thing there-
from but water and Earth. You
are not ignorant also, That rot-
ten wood which hath no Acid
and

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and Alkali Salts, and which hath nothing but some Flegm and Earth, hath no more any action.

PYR. I could wish you would a little longer explain what you mean by the words **Fermentation** and **Precipitation**, whereof you make use so often.

EUBUL. By the Word **Fermentation**, I mean an Internall Motion of all the parts of Bodies which are fermented in such Manner that they take no more the same place nor situation as they had before, and that they change consequently, or at least alter very much the nature of the bodies which are fermented: as for the difference of **Effervescence**,
in

Acid & Alkali. 77

in which there is made only a simple Motion of the integral parts of Mixts by the force of some exteriour Agent, as Fire; the which parts re-take afterwards the same scituation which th^y occupied before, unless their natures and qualities be in any wise changed.

There are several sorts of fermentations in Nature; some are made with Effervescence, as that which happens upon the mixture of Oil of Vitriol with Oil of Tartar: and others are made without Effervescence, as it happens in an Egg which a Hen hatcheth; and in common Water, when one casts hereinto some Drops of well-leslegm'd Spirit of Vitriol, and this Fermentation is known only

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ly by the Heat which we feel at that instant : There are some which are made without Heat, as that which is made of Vitriol dissolved in water with Oil of Tartar : There are some which are made with Fires and Flames, as the Fermentation which is made of Calx Vive in the time it is sprinkled with a little Vinegar : and others which are without Fire or flames, as are the ordinary Fermentations. There are still some sensible and insensible ; sensible, as the Fermentation of Spirit of Niter with Oil of Tartar : and insensible, as that of Wine which sours.

PYR. Whence comes it that there are so many sorts of Fermentations ?

EUE

Acid & Alkali. 79

EUB. Either Bodies are fermented of themselves, as Wine; or they are fermented by means of a Ferment, as Dough with Leven; either the Acid Salts and Alkali Salts are Exalted, or else they are Intangled one in the other: and, in the Passive principles, one of them is exalted, and the other Intangled; or, one of them is in a great quantity, and the other in a small quantity.

If the Acid Salts and Alkali Salts are each as powerful ^{and} as the other, the Fermentation cannot be made without Heat and Effervescence, as of spirit of Niter with oil of Tartar; if, on the contrary, one of these two Salts is weak and the other strong, as are the Alkali

80 *Discourses upon*

kali of Water, and the Acid of Oil of Vitriol well deslegmmed, there is only made a little heat without effervescence : in the Acid, which is mingled with the Alkali, is dis-intangled from its own Alkali and passive Principles ; as the Acid of Oil of Vitriol, there is made a Fermentation with Heat and Effervescence : and, if on the contrary, the Acid is intangled, as in Vitriol in its Body; there is only made a Fermentation with Effervescence without Heat: In like manner, if these two Salts are exalted and dis-intangled one from the other, and from the passive Principles, they take fire at the same time that they ferment, as Calx vive doth when it is sprinkled with some Vine

Acid & Alkali. 81

Vinegar. In a word, if these two Salts are weak, the Fermentation is insensible.

There are few Fermentations made, but there is at the same time made a Precipitation; tho' there are several Precipitations made without Fermentation, as in the Precipitation which is done by Acids of Mercury sublimate dissolved in Water.

Precipitation is a Dis-union of a dissolved Body from its dissolvant, in such manner that being separated therefrom it falls by its own weight to the bottom of the vessel which contain'd it.

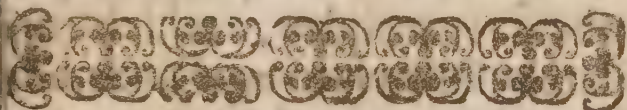
Precipitation is made several wayes; for, either it is an Acid which holds an Alkali in
G disso-

82 *Discourses upon*

dissolution; or, its an Acid which is dissolved by an Alkali, as it happens in the Composition of Regulus of Antimony, in which the Sulphur of Antimony, which is an Acid, is separated from the Regulus, and remains in the Fæces dissolved by the Alkali's of Tartar and Niter. If it is an Acid which holds an Alkali in dissolution where the union is so perfect that there is not the least Pore empty (as in all the compound Mineral Salts, as Vitriol) the Precipitation cannot be made but by an Alkali; or else where the union is not so perfect, and there remains a great many Pores which are not filled by this Acid, as in corrosive sublimate; The Precipitation

Acid & Alkali. 83

ration may be done as well by
Acids.



OTHER DISCOURSES UPON Acid & Alkali.

PYROPH. **T**HOSE Arguings
which we had
at our last Meeing have almost
wholly perswaded me of the
Verity of the Hypothesis of
Acid and Alkali: But I must
G 2 confess

84 Mr Boyle examin'd,

confess, dear EUBULUS, that
I have been extreamly shaken
by the Reflections of the In-
comparable Mr. Boyle upon
these Principles, which are
lately fallen into my hands, and
the Objections which he makes
are so strong, that it seems im-
possible to bring a solution
thereof.

EUB. I doubt not but that
the Objections which the learn-
ed Mr. Boyle makes against
Our Hypothesis have much
seeming Truth in them; but ne-
vertheless, I believe that they
may be resolved with great
Ease, when one very exactly
considers what I have said to
you concerning the nature of
these two Principles, and as
their force will serve to make
th

Acid & Alkali. 85

the Truth of this Hypothesis
he more conspicuous.

PYR. Mr. Boyle thinks it
strange, That they should ex-
plain all the Qualities of Bo-
dies and the other Phœnome-
na's of Nature, by this new
System; and, that they attri-
bute to it an Extent which
ought only to be given to Mat-
ter and Motion.

EUB. You may easily con-
clude by the several Phœnome-
na's of all sort of Species which
I have explained to you accor-
ding to these Principles; That
it will be easy to Explain all
those which they shall be able
to prefer: and I do not see Why
the Extent that is given to this
Hypothesis, ought to be diffe-
rent from that of Matter and

86 *MrBoyl examin'd,*

Motion, since that in it self is found the Existence of the Matter and Cause of Motion.

PYR, Our illustrious Englishman pretends, That they have not made Experiments enough, nor sufficient Inductions to prove, That Acid and Alkali are to be found in all Bodies, and in all the sensible Parts of Mixts; and, That they ought not to conclude, that these Two Salts are to be found therein, because such or such Effects are the Emanations of these Principles; as for Example, When the Patrons of Acid and Alkali see Aqua Fort. or Spirit of Niter dissolve Filings of Copper, they conclude thereupon, That the Dissolvant which is Acid, meets, in those filings of Cop-

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Acid & Alkali. 87

per, with an Alka'i upon which it works: Whereas they do not take Notice, That a well deflegm'd Spirit of Urine, which in their Hypothesis is a Volatile Alkali, dissolved in a little Flegm, do's dissolve filings of Copper as readily, and much more naturally than AquaFort. doth.

EUB. I believe you have sufficiently proved by those Experiments which I brought you, That there is Acid and Alka'i in all parts of Mixts. It is most easy to separate these Two Principles from Anima's, Vegetables and the most part of Minerals; but as for Metals, These Principles are therein so strictly united one with the other, That it is almost Impossible to

88 *Mr Boyle examin'd,*

dis-unite them: Nevertheless, we see therein the same Effects as we know are produced in other Bodies by Acid and Alkali, and therefore, we have good ground to believe, That these principles are also to be met with therein, and, That the same effects are produced by the same Causes. Thus, when we see Spirit of Niter and the volatile spirit of sal Armoniack dissolve filings of Copper, we conclude, That there is Acid and Alkali in those filings, and, That the Acid spirit of Niter acts on the Alkali which it finds therein; and the sharp spirit of sal Armoniack on its Acid: for, 'tis a sure Maxim That Acid spirits never act nor ferment but with Alkali's: and

Al-

Acid & Alkali. 89

Alkali's, on the contrary, never act upon any other Bodies but Acids : and thus Mr. Boyle's Objection is of no force, seeing Spirit of Niter and Spirit of sal Armoniack meet in the filings of Copper with different Parts upon which they act differently, and they act not any other-wise on the same subject.

PYR. He continues his Objections by an Experiment like the former : He saies, That in the Solation which is made of Iron by Acid Spirits, they are wont to attribute this Effect to the Acidiry of the Liquor which dissolved it, although Iron is dissolv'd redily enough, and also in the Cold too, in sharp Spirits.

EUB. This Objection is as easily resolved as the former :

for there is found in Iron, as
there is in Copper, Acid and Al-
kali; The Spirit of Niter acts
on its Alkali, and the Spirit of
fal Armoniack on its Sulphur
or Acid, and 'tis sufficient that
the one or other of these Two
Liquors act upon the Alka-
li or Acid of the Iron to make
the Metal change its Form :
as for the rest, it is sufficiently
easy to know, That there are
Acid and Alkali in Iron by
this, That Iron cast into Cream
hinders that the Butter cannot
be made, in as much as it char-
ges it self with the Acid which
ought to make the Coagulati-
on: and there are none but Al-
kalies which have the Privi-
ledge to produce this Effect :
Acids assisting to make this Co-
agulation,

Acid & Alkali. 91

agulation, as Country-women observe; Therefore consequently there may be Alkali in Iron. We see likewise by another familiar Experiment, That there is Acid in Iron, for, if one puts a bit of iron into Sauce, wherein there is some Gall, as in that of a Carp, the Gall of which one has broke; all the Volatile Alkali which causes the bitterness of the Gall joins it self to the Iron and the Sauce remains sweet: How should this be, that this Volatile Alkali doth join it self to the Iron, if there was not Acid in the Iron, seeing Alkali cannot produce such an Effect; it follows therefore, That there is Acid in Iron.

P Y R. He afterwards demands

92 *MrBoyle examin'd,*

mands the Reason, Why Mercury, (which dissolves Gold so readily, it being a hard and solid Body, and reduces it into an Amalgama) acts not at all upon filings of Iron, though this is a Metal so open that Liquors weak enough work upon it.

EUB. Two things contribute to this Effect: The first is, That there is a great deal more Sulphur in Gold than in Iron, and consequently, Mercury (which abounds in Alkali) can rather work on Gold than on Iron: The second is, That the Sulphur of Iron is intangled in a great quantity of Earth which hinders the Action of the Mercury which has not parts sufficiently subtile nor sufficiently pene-

Acid & Alkali. 93

penetrating to dis-intangle it, as the Spirits of Niter and Sal Armoniack do, whose parts are so thin and so agitated that they dis-intangle the parts of the Iron one from the other, and makes a Dis-union of its Sulphur and Alkali: it is not so of Gold, whose Sulphur is only intangled in its Mercury, and, which hath only a very little Earth, which is not strong enough to intangle the parts of the Sulphur and Mercury of Gold.

PYR. The same thing happens, which he pursues to the same End: In the Precipitation which is made of Corals and Pearls dissolved in distilled Vinegar with Oil of Tartar made per deliquium: Chymists attribute

bute this Precipitation to the Alkali of Tartar, which absorbss the Acid spirits of the Dissol- vant, and nevertheless we see That Acids precipitate them as well as Alkali's.

EUB. I do not wonder, That Acids precipitate equally with Alkali's, Corals and Pearls dissolved in distilled Vinegar: Yet that does not at all destroy the Reason, That they are wont to render when it is made with Alkali's: for, there are, as you know, Two sorts of Dissolutions in Nature, either an Acid dissolves an Alkali, or else an Alkali dissolves an Acid: if it is an Alkali which holds an Acid in Dissolution, the Precipitation cannot be made but by an Acid, for then the Alkali which held

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held it in Dissolution quits it
to join it self to the new Acid
that is cast thereto : If, on the
contrary, 'tis an Acid which
holds an Alkali in Dissolution,
either the Alkali dissolved by
this Acid is mixed intimately
with its dissolvant, in such
manner that the dissolvant fills
exactly all the pores of the
dissolved body, as it happens
in Vitriol of Mars; or, the
dissolvant do's not penetrate
the Body but superficially, and
do's not thoroughly fill the
pores thereof, as we observe in
Mercury dissolv'd in Aqua fort.
and in Coral and Pearls dissol-
ved in distilled Vinegar : If it
happens that the Acid spirit
penetrates intimately the Bo-^{dy}
to which it is joined, and that
those

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those points be of the same figure and grossness, as the Pores of that Body, the Precipitation cannot be made but by an Alkali which charges it self with the Acid which held that Body in dissolution, and makes it at that instant to quit its hold: The which Acids cannot do, because that not finding therein any Vacuity they cannot work upon it. If the Dissolvant is not mingled per minima with the dissolved Bodys, an their points are not of a figure proportionated to those of the pores of the Body, the Precipitation thereof may be made by Acids and Alkali's: by Alkali's after the same manner as I told you but now: and, by Acids because the points of these Acids work upon

Acid & Alkali. 97

upon those of the Dissolvant, causing them to quit their hold: for, the Body being no longer agitated nor detained by those points, it falls by its own weight to the bottom of the Vessel which contains it. Thus when Oil of Tartar precipitates Corals and Pearls dissolved in distilled Vinegar, they have Reason to say, that this Precipitation is done, Because the Alkali of Tartar has blunted and charged it self with the points of the distilled Vinegar which held the Coral and Pearls in Dissolution, altho Acids precipitate also this Dissolution.

PYR. Our Author saith, Chapter the Third, That the Admirers of Acid and Alkali seem to have assign'd, arbitrari-

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ly certain Extents and Employments to each of these Principles: as for Example, That an Acid doth, in quality of an Acid, such and such Operations; and the Alkali's in their quality the like also: and, That from thence depends all the Phenomena's of Nature; and, That they ought not to promote, in publishing, Propositions of this Importance, without good and sufficient Proofs thereof.

EUB. Does not Experience teach us, That Acids, of whatever Nature they be, coagulate Blood, Milk, &c. That they ferment with all Alkali's, and never with other Acids: That they constitute the Essence of all Bodies, that they are the pointed Bodies which fills up the

Acid & Alkali. 99

the Vacuities of Alkali's, and which are the absolute Masters thereof; That Alkali's, on the contrary, dissolve Blood and Milk coagulated by Acids: That they hinder them also from being coagulated; and, that their parts are not dis-united one from the other: For Example sake, If one mingle some volatile Spirit of Sal Armoniac with new Milk, or with Blood so soon as it comes out of the Vein, it conserves them in their Consistence for a great while, and hinders them from being corrupted: Alkali's whiten Linnen and Stuffs; they ferment ~~with~~ all Acids and never with other Alkali's: These are the little Bodies full of holes and wholly vacuous:

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with

100 Mr Boyle examin'd.

in a word, They precipitate Vitriol of Mars dissolv'd in Water, which Salts nor Acids can never precipitate: You thus see plainly, That they assign not in vain, these nor several other Effects to Acid's and Alkali's, seeing Experience teacheth you, That they are alwaies and at all times the Cause thereof.

PYR. He affirms also, That the Division of Salts into Acid and Alkali is purely arbitrary, and, That they may divide them otherwise: Acids and Alkali's having not only in a great many things some agreement: but also salts of one and the same Denomination being visibly different in several chief points: as Alkali's, whereof some

Acid & Alkali. 101

some are fixed, others volatile; and some thereof give a Precipitation of corrosive Sublimate dissolved in water of a tawny colour, as salt of Tartar; others a white colour, as spirit of Urine, Harts-horn, &c. Finally, some act very slowly on filings of Copper, as Oil of Tartar made per deliquium, and others dissolve it with readiness, as spirit of Urine, &c. he adds also, That there is no less Difference between Acids: some dissolve Bodies which others cannot dissolve, as Aqua Fortis which dissolves Silver, Mercury, &c. and touches not Gold: and, as Aqua Regis which dissolves Gold, and touches neither Silver nor ~~the~~ other Metals: Spirit of Vinegar well de-

H 3 flegm'd

flegm'd dissolves Lead in the Cold, and reduces it into minute parts, which Spirit of common Salt cannot do: and he concludes this Chap. demanding whether Acid and Alkali have the Simplicity that a Philosopher requires in Principles? and in Smiling at the Definition that they are. Wont to give That Acid is an Enemy to Alkali, and Alkali to Acid.

EUB. The Division of simple Salts into Acid and Alkali is as Just and Exact as can be wish'd. Acids and Alkali's having no any agreement in Virtue and Property, and the one never produceth the Effects of the other: as Mr. Boyle would have it: as for Example, Alkali's are Bodies vacuous and full

Acid & Alkali. 103

of holes, which precipitate Vi-
triol of Mars dissolved in Wa-
ter, which whiten Linnen and
Stuffs; which make a Dissolu-
tion of Milk and Blood coagula-
ted by Acids. &c. Acids, on the
contrary, are pointed Bodys,
which fill up the little holes
they meet with in Alkali's,
which foul Linnen and Stuffs,
which coagulate Blood and
Milk, &c. in a word, which
have not any of the Properties
of Alkali's. And, though Salts
of one and the same Denomina-
tion differ in some things, yet
nevertheless, they all agree in
Nature and use: for we see,
That Alkali's, whether fixed or
volatile, are Bodys full of holes,
That they all precipitate Vitri-
ol of Mars: That Acids, on
H 4 the

the contrary, are pointed Bodies, &c. so that when some Alkali's precipitate corrosive Sublimate dissolved in water, into a tawny coloured Powder, and some others into a white powder, that does not prove, That they have a different Nature one from the other, but that comes from the Diversity of their Pores, some having them more conformable to the Acid which had sublimed the Mercury and others less, and they blunt after this manner more or less the points of those Acids, whence comes the Diversity of colours of the precipitate: It is not also the Diversity of Natures that makes that Volatile Alkali's dissolves Copper more readily

Acid & Alkali. 105

asily than fixed Alkali's do :
but only the greater agitation
of their parts : all Acids work
on Silver and the other Metals,
but more or less, according to
the greater or lesser Relation
their points have with the
pores of those Metals : These
Acids never work on Gold
which cannot be dissolved but
by salt Menstruums, as I have
said else-where. And, whatso-
ever Mr. Boyle says of spirit of
Salt, which he cites for a most
powerful Acid, is Salt, and not
a pure Acid, notwithstanding
the Acid seems to predominate
therein : and , That is the
Reason why spirit of Salt works
neither on silver nor ~~the~~ other
Metals.

These two Salts have the
Simplici;

106 *Mr Boyle examin'd.*

it Simplicity that a Philosopher requires in Principles, because they are composed of Particles of one and the same Nature, and can never be resolv'd into any other Substances. In respect of the Definition which Mr. Boyle relates of Acid and Alkali, he has Reason to blame it, because ~~he~~ doth in no wise explain the Nature of these Principles, no more than if one should say, That that which dissolves a Body dissolvable by an Acid, ought to be an Acid: &, That all which precipitates a body dissolv'd by an Acid, ought to be an Alkali: but Mr. Boyle cannot say the same thing of the Definition which I have already so many times repeated concerning Acid and Alkali:
That

Acid & Alkali. 107

That the Acid is a Salt composed of small pointed parts which ferment with Alkali's & makes the Essence of all Bodies : The Alkali, on the contrary, is a vacuous Salt which ferments with Acids, and precipitates Virriol of Mars dissolved in water. This Definition explains clearly their Nature, Kind and Difference; for, these two Principles agree in that they are Salts; and they differ in that one of them is pointed, and the other porous and unequal, and that one fills the Pores of the other, and is its absolute Master.

PYR. This Famous English-
Man will not allow, That the
Fermentation or Heat and Ebu-
lition which is caused when
these

Chap. 4.

these Two Salts are mingled together, is a sure Token to know Acid and Alkali : For, he pretends, That these Effects depended principally on the Mechanick Disposition and Construction of Parts; and, That 'tis sufficient to produce heat when the parts of a Body are agitated with vehemence on all sides : and, for the Ebullition, That the Bodies which are mingled intercept the parts of the air, or the warm Vapours in the time that they are excited; and, That there happens often in this mixture Heat without Ebullition, and Ebullition without Heat : He relates some Experiments of both : For, he saith, When Oil of Vitriol, which is a powerful Acid; or, Salt of Tartar, which

Acid & Alkali. 109

which is a powerful Alkali, are mingled with Water which is neither Acid nor Alkali; There is at that time a considerable heat excited, without any Ebullition: and, That on the contrary, in the Mixture which is made of spirit of verdigris, made per se, which is an Acid, with salt of Tartar: there is made a great Ebullition and roils Froth without any remarkable heat.

EUB. It is very true, That the Heat and Ebullition which happens in Fermentation, depends upon the Mechanick disposition and Construction of the parts of Bodys which are Fermented: But this Construction or Disposition likewise depends wholly upon the different nature

ture of Acids and Alkali's, and their divers mixtures one with the other, as I have already caused you to observe, where I spoke of Fermentation and its Differences, which would be needless here to repeat: as for the oil of Vitriol and Salt or Tartar which heat water when they are dissolved therein; you shall observe, That there is in Oil of vitriol, a metallick part of Iron or Copper according to the Nature of the Vitriol which was elevated in the Distillation by the Acid of that Salt, an Experience sufficiently teacheth us: This oil coming to be dissolved in the water, there is then made a separation of the Metallick part from the Acid which had elevated it, and a

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Acid & Alkali. III

action of that Acid upon the Alkali of the water; which is powerful enough, since it hardens red hot Iron, and hinders it from going into scoria's, when it is squenched therein, for, there is none but Alkali's which can produce this effect: then there is made on all sides an agitation of their parts, with sufficient Vehemence, whence comes the heat which happens in this mixture. In regard of that which results from the mixture of salt of Tartar with water, you shall understand that salt of Tartar does not heat water, but when it is too much or too little calcined: when it is too much calcined, it is charged with an Acid from the fire, which coming to be dissolved
in

in water, it separates it self
 from the Alkali of the Tartar,
 and acts upon that of the water,
 and causes, as I have said but
 now, the heat in the water: and
 when the Tartar is not suffici-
 ently calcined, it retains some
 of its own Acid, and becomes a
 little near the nature of Calx
 vive, which causes it to fer-
 ment in water: but when this
 Salt is neither too much nor too
 little calcined, it dissolves sim-
 ply in water without causing
 therein any Heat, as all pure
 Alkali's do.

PYR. He afterwards comes
 to speak of the Taste, which he
 saies, is as the Touch-stone to
 know Acids and Alkali's: he
 saith thereupon, That there are
 a great many mixts, in which
 the

Acid & Alkali. 113

the Taſt can ſo little diſcern which of thoſe two Principles predominate therein, that one cannot ſuſpect that there is in thoſe two Bodys the leaſt part of thoſe Two Salts, as in Diamonds, Rubys, Gold, Silver, &c. That there are alſo ſeveral Bodys which abound in Acid and Alkali Salts, yet have no taſt at all, or, which have one altogether different from that which the Chymiſts attribute to their Principles, as Venice Glaſs, which is inſipid on the Tongue, though it is almoſt nothing other thing but fixt Alkali; and as Criſtals of Silver and Lead made with aqua fortis, whereof the firſt has an extream Bitterneſs, and the laſt, the ſweetneſs of Sugar; neither of which

retain any thing of the Acid of the aq. Fort. which did dissolve those Metals.

EUB. By the Taste we can only know pure Acids and Alkali's, as the Spirits of Sulphur, Niter, &c. which are taken Notice of by their acidity: and as the volatile Alkali's of Viper, Harts-horn, and fixed Alkali's, as lixivial Salts, which are known by their great acrimony: as soon as these two Salts are mixt together they produce different Savours according to the divers Mixture and particular figure of their Parts: It happens also very often that a body which experience teacheth us is acid, being mingled with a Body which Experience makes us know

Acid & Alkali. 115

~~Conclu~~
to be an Alkali, they being insipid: as for Example, When four parts of Cream of Tartar dissolved in Water: in which may be manifestly seen, that the Acid predominates, is mingled with two parts of Salt of Tartar dissolved also in water, there is made as soon as they come together a Fermentation sufficiently violent, from which afterwards is obtained, by Crystallization, a salt which is altogether insipid. You see by this Experiment, That though a Body be insipid, nevertheless one may not conclude, That it contains neither Acid nor Alkali therein.

PYR. Mr. Boyle pretends in the fifth Chapter, That the Hypothesis of Acid and Alkali is

neither Necessary nor Usefull to explain that which happens to qualitys; Whereof some are produced, others destroy'd or altered; it not appearing, That these two Principles contributed in any wise thereto; as when Water is changed by the force of Beating into Froth, which hath some Consistence: or, as when Coral which is red and transparent, is changed into a white and opacous Powder, without doing any other thing thereto than reducing it into a Powder sufficiently subtil to pass through a fine Searce.

EUB. The Froth which is formed on water by Beating comes only from the agitation of its parts, and as there are a great

Acid & Alkali. 117

great many Alkali parts, and also some Acid parts, and a little Earth to be met with in water, it is certain, That these Principles contribute to the Production of this Quality. It should be needful that Mr Boyle prove, That there is no Acid nor Alkali in water, to conclude That Acid and Alkali do not contribute in any wise to the production of this new Quality; which is impossible to be done: as for the Coral, which becomes white and opacous when it is reduced into an Impalpable Powder: I shall tell you, That the most part of Bodies are destroy'd by Trituration, and entirely change their Nature, and those also which are harder and solider: and if we may believe

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lieve some of the Renowned Chymists of our Age, as the famous Langelot, Olaus, Borrychius, Schroder, &c. Leaf-Gold is destroyed in such wise by a long Trituration, that it is impossible to make it retake the form of Gold, whatsoever artifice you use: so that it is not strange, That Coral which is red and transparent, should become white and opacous, when it is reduced to an impalpable powder, because that in the Trituration which is made thereof, its parts are dis-united in such wise one from the other, and are in so great a confusion, that they can no longer keep their natural colour, either because they do no longer reflect the light as they did reflect it
be-

Acid & Alkali. 119

before; or, because they do not make the same Impression on the aier: or lastly, that the Atoms which go out therefrom are not conditioned as they were: and this colour cannot return to it, except by the force of some exterior agent its particles retake the same place, and the same situation as they occupied before the Trituration: as we take notice of it in blew Vitriol, which becomes white when reduced into powder, and which retakes its natural colour when this powder is dissolved in water, and afterwards caused to cristallize.

PYR. He proceeds with an Objection like the former; He saies, They cannot render a

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Reason by Acid and Alkali of Gravity, Light, and several other Qualities, which are called **MANIFEST**; and much less of those which are called **OCCULT**: as of the Force of the Loadstone on Iron, and of Iron on the Loadstone, as well as several other Phænomena's of the Loadstone.

EUB. The gravity and levity of a body depends upon the more or less of Vacuity that there is in that body, according to Mr. Boyle's Opinion, in such manner, That a body in which there are fewest Vacuities, is most Weight, as, on the contrary, that in which there are more vacuities, is more light. Now the More-ness or Lessness of Vacuities depends upon the

More-

Acid & Alkali. 121

Moreness or Lessness of the Acid which there is in Bodies: For, when there is a great deal of Acid therein, the Pores of the Alkali are filled therewith; and, when on the contrary, there is but a very little Acid, those Pores remain empty, and consequently the gravity of a body depends upon the quantity of Acid that is found therein, and the Levity upon the smallness of the Acid and quantity of Alkali which is found there: The abundance of Caput mort. contributes much to the lightness of Bodys, as we observe in the Firr-tree which is a very light wood, and hath much earth in it. Light is no other than an agitation of small pointed Bodys which are poured out

out in the air, and puts all the parts thereof in Motion : It is of the same Nature with fire, since it produceth the same Effects, and that being re-united in a burning-glass, it liquefies Metals and calcines Stones and fire doth, which is Acid, as I have proved else-where, and by consequence Light ought also to be an Acid, since it hath all the qualities thereof. The Effects which are attributed to qualities, and are called OCCULT draw no less their Original from Acid and Alkali than the manifest Qualities, which I shall shew you when I speak of some Effects of the Load-stone ; The most considerable whereof is, That where by it draweth Iron. You shall take

Acid & Alkali. 123

Take notice therefore, That Iron is an imperfect Load stone, which hath Pores of the same figure with those of the Load-stone, and which are filled with the same Particles as those wherewith the Load-stone is filled. We see likewise, That Iron, exposed to the air a long time, becomes Load-stone, since it acquires the qualitys thereof, as the Crosses which are upon Churches, these in Succession of time become Load-stones, and produce the same Effect as the Load-stone. You shall likewise take notice, That there are a great many more Pores in the Load-stone than there is in Iron, and, That the force of the Load-stone consists in the small pointed Bodyes that fill these

these pores; Iron becoming Load-stone in the air, furnisheth us with a most convincing Proof thereof; for, Experience teacheth us, That all porous Bodies are charged in the air, with an Acid of their own nature, as the earth from whence Salt-petair has been drawn, which is there in charged with a new Salt-petair, which is acid, &c. Lastly, you shall observe, That there goes out continually from the Loadstone a multitude of these little pointed bodies, and at the same time there enters therein to others which retake their place, because the air is wholly filled therewith: This being granted, it is sufficiently easy to render a reason for the attraction of Iron by the Load-stone.

The

Acid & Alkali. 125

The attoms which go out continually from the Load-stone insinuate themselves into the Pores of the Iron and fills them; These Corpuscles cannot go out from the Load-stone, but at the same time they agitate the air with violence, this agitated air throws the Iron against the Load-stone, or the Load-stone against the Iron, according as the one of these Bodies resists it, and after this manner the Load-stone attracts Iron, and Iron the Load-stone. You see plainly, That this Virtue, which did formerly silence all the Philosophers, is explained by our Hypothesis, and that, after a manner so natural, that it is easy to judge, That all the other Phenomena's of the Load-stone ought

ought, as certainly to be produced according to our Principles.

PYR. Mr. Boyle, in Conclusion, makes an Objection, which to me seems sufficiently strong; he demands, How in the Dissolution of Metals, their Parts are sustained by the Dissolvant though the Metall be in equal bulk nine times heavier than the water; and if it be Gold, nine times heavier than the liquor which hinders it from sinking, and always a great deal heavier in particular, than the Salts which compose the Dissolvant, which can render the water in which they are mingled.

EUB. It is easy to comprehend how the parts of Metals dissolved in Acid spirits, sharp
Spi-

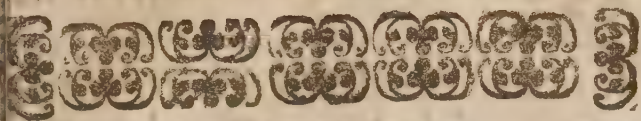
Acid & Alkali. 127

spirits and salt Menstruums are sustained by these Dissolvants : It is because their parts are continually agitated by those of those Liquors whose motion is sufficiently strong, and sufficiently rapid to carry them with them, and to hinder them from precipitating.

PYR. I did not believe, That you were able, without seeking some other Principles than these which you have established, to satisfy the Objections of the illustrious Mr. Boyle : But you *have* raised all the Difficulties thereof with so much Force, that they have only served to give a greater illustration to your Principles, and to shew the extent hereof, and their Conformity to Reason and Experience.

NOW,

NOW, seeing a Genius so delicate, and which knows Nature so exactly, as that Learned Man, has not been able to give them any Attaint, I doubt not but day by day they will be confirmed, as we make new Discoveries therein; and, that they will remain firm and steadfast against all that can be employ'd to shake and destroy them.



A REPLY
TO
A LETTER
OF
Mr. S. touching the Nature of
Acid & Alkali.

S I R,

NOne can doubt but there
is much Honour to be
acquired by Publishing
the New Discoveries which
are made in Physick and Medi-
cine ; but, I must also confess,
That it is not Advantageous to
write, when we are moved
thereto only by Envy, to cen-
sure

sure the Works of others, without considering, Whether the things that we write are indeed what they seem to be in the Imagination. This is the Difference that there is between the manner whereof Mr. Houpeville hath faithfully communicated to us the Observations which he had made upon the Corps of a Woman, and that whereof you freely attack him, without being in any wise obliged thereto: Yet I am less surpris'd at it than at your proceeding concerning the Faculty of Caen, which you treat after the sharpest and violentest manner in the World: which cannot proceed but from a Spirit very little inclined to speak well of any one; and all the
abu-

Acid & Alkali. 131

abuses which can be made against a Faculty whose Reputation is so well established, and hath so just a Title, cannot but return with Disgrace upon their Author, since no Body will ever balance the Authority of a particular person, who aims to be known only by the Faults which he endeavours to discover in others, with that of a Society, whose Doctrine and Exactness have rendred it so famous, and which (without speaking of those which adorn their places so worthily at present) hath produced Men most Famous in their time, such as were Cahagneſe, Dalechamp, Schroder and several other Famous Doctors, whose Names will last as long as the SCIENCE

K 2

132 *Mr Boyle examin'd.*

ENCE to which they have applied themselves : and all the ill Treatments which Envy and Jealousy can borrow of Railery and supposition, will but increase the true Esteem we ought to have for it. Likewise there are some persons whose Judgments are so little conformable to the Rules of Reason, that a man may be esteem'd by displeasing them. I know not whether the Praises which you give to the celebrated Faculty of Montpelier, whereof you call your self Doctor, be not more prejudicial than advantageous to it ; and the manner by which you Depick'd it, a Slave to the Opinions of the Ancients, and an enemy to the new Anatomick and Chymick Discoveries : where you say, It can-

Acid & Alkali. 133

not Deceive, nor be Deceived, Pag 3.4.
because it does not receive any
Novelties, if the contrary was
not known, it would be thought
blind, and incapable to be in-
lightened by those Lights which
the Exactness of the Anatomists
and Works of the Chymists of
our time have discovered to us.
I know well, That the Light-
ness to change Opinions, and
the too great Aptness to receive
Novelties, is a Fault; but not
greater than wilfully to retain
an old Error, and refuse one's
Consent and Belief to a Truth
but lately found out. Truth is
not of any Age, it is not subject
to Years, but it is in it self E-
ternal; and 'tis only the Ob-
servation we make thereof that
is of such a year. A Geogra-

K 3

pher

pher could not handsomly deny, That there is a fourth Part of the World, because Pto- lomy, Strabo and other antient Geographers did not know it. How fair soever the Descriptions be which antient Anatomists have made on MAN, yet they have left to us some Parts of this Microcosm to be discovered, which tho they be not of any great Extent, nevertheless they are of extream Importance for its Conservation: and our antient Philosophers have not penetrated so deep into the Secrets of Nature, but that we have Discovered by means of CHIMISTRY many things which were unknown to them. You observe so little the Maxims for which you praise the
Fa-

Acid & Alkali. 135

Faculty of Montpellier, that without fear to cheat or be cheated, you reason by Principles all-together unknown to the Antients: and, you admit several new Anatomicks and Chimicks, but you turn them so particularly, that they become unknown to their own Inventers: and, I know not but the use which you make thereof will rather serve to Destroy then to Establish them.

The manner by which you explain Nutrition, Renders us not much more knowing; You tell us, The Chyle is made in the Stomach, without teaching us the manner thereof; That it falls afterwards into the Intestins, where it is fermented with the Bile and splenetick

K 4

Juice

pag. 79, &
107

Juice without explaining to us the Cause of this Fermentation: and you go on with an evident false supposition, That it is carryed to the Liver by the Vena Porta; after, having passed through the Tunicks of the Intestines, to acquire therein the form of Blood. For, to discover the Cause and Means of these Operations, it must be observed, That there is an Acid Liquor in the Stomach, which produceth them therein; Whether this Liquor be brought thither by the extremities of the Arteries which terminate there; or else it is the remains of the Aliments which grow sour by abiding there, and which serve as Leven to those that are taken afterwards, as we observe
that

Acid & Alkali. 137

What Dough grows sour by age, and then it can ferment a great quantity of new. The existence of this Liquor needs not be doubted of, nor that it is a powerful dissolvant: The Bones which we find half digested in the Stomachs of Dogs, and the Copper which we find half corroded and half dissolved in the Stomachs of Ostriges and Drakes, are sufficient Testimonies thereof.

And we may perceive that this Acid Liquor was not unknown to the incomparable Hippocrates, when he saith in the first Aphorism of the sixth Section, *In longis levitatibus Intestinerum si rectus Acidus superveniat, bonum*, In long Loosenesses of the Intestines, if acid Belchings

ings supervene, it is good, for 'tis then that this Liquor begins to be renewed and to execute its functions. When the Stomach is empty and this Liquor is fallen thereinto, in a sufficient large quantity; or else (if you please) the Ferment is sufficiently exalted, it excites Hunger, for then it strikes the superior Orifice of the Stomach, which is wholly nervous, and of a most delicate Sense, and produceth in us different Appetites according to the particular Nature and different Figure of its Particles; whence it comes, That we do digest more easily those aliments to which our appetite excites us, because they have much conformity with that Acid. This Liquor serves

not

Acid & Alkali. 139

not only to excite Hunger, but also to dissolve the Aliments which we take, and to convert them into Chyle: for, after the Aliments have been prepared in the Mouth by mastication, and by the mixture of the Spittle, they are cast by the Tongue into the Oesophage, and fall at the same time into the Stomach, as well by their own weight as by the impulsion of the Muscles of the Oesophage, the acid liquor of the Stomach is immediately mingled with them, scattering the parts thereof from ^{other} ~~the other~~, and bruises them, and attenuates them, and by the continual agitation and motion which it makes thereof, it causes them entirely to change their Nature; and, according to the relation that this liquor has with

the aliments which we take; the Chylification is made more or less perfect, and in more or less time. The Stomach being continually pressed by the Diaphragma in the time of Respiration, the Chyle falls insensibly into the Intestines, where it is confounded with the Bile and pancreick Juice, and then there is made a Fermentation of the Chyle with these two Liquors, during which time, the more subtile parts, and consequently the more proper to nourish the animal, are strained, and pass through the Tunicks of the Intestines, and the grosser parts are cast out backwards by the anus, as well by their own weight, as by the peristaltick Motion of the Intestines. *Sylvius*
us

Acid & Alkali. 141

us de le Boe, Graaf, Suale, &c. have attributed the cause of this Fermentation of the Chyle with the Byle and pancreick Juice to the acidity of the pancreick Juice; but experience hath taught our more curious Anatomists, That this Juice is not in any wise acid, but altogether insipid, and therefore, That cannot be the cause of this Fermentation; and to discover the true Cause thereof, it must be observed, That when the Chyle falls from the Stomack into the Intestines, it is of an acid salt taste, because of the Mixture of the Acid of the Spittle and of the acid Liquor of the Stomach with the volatile Alkali of the Aliments; for, as I have shewed in my foregoing Discourse

course, that Acid Salt Bodies are compos'd of a Mixture of Acid with Alkali. This Taste is found manifestly in the Chyle; and 'tis, in other Cases, a constant Maxim, That Acid Salt Bodies being mix'd with some Alkali, and dissolved in some Menstruum (for Salts act not except dissolved) are ferment'd, as Vitriol of Mars doth, being dissolved in water, with Oil of Tartar made per deliquium. The Chyle then being an acid Salt, and the Bile abounding in volatile Alkali, they are ferment'd as soon as they come to be dissolved by the pancreick Juice. This Fermentation cannot be made but at the same time there is made a Precipitation of the Fæces, and the more subtile parts

Acid & Alkali. 143

parts pass into the lacteal Veins,
and not into the Vena porta,
and from thence into the Liver,
as you suppose: for, if the Branches
of the Vena porta, in the
time of the Distribution of the
Chyle, be tyed, they are found
only filled with Blood, and if
they be separated with the Li-
ver from the Intestines, there is
likewise not lost one drop of
Chyle, but it is carryed conti-
nually from the Intestines into
the lacteal Veins, from these
veins into the two Receivers of
Pequet, and then into the tho-
rachick Pipe, where it is ming-
led with the Lympha which is
discharged thereinto from the
inferiour parts, and ascending all
along by this pipe, it is dis-
gorged into the left subclavial
Vein,

Vein, where it is confounded with the Blood; and, continuing its way it falls into the descending Vena Cava, where it is still mingled with the Blood that it contains, and the Lympha which flows thereto from the superiour parts; it enters lastly into the Heart, where it is subtilized, and begins to be changed into Blood, and by circulating several times from the Heart into the arteries, from the arteries into the Veins, and from the veins into the Heart again, it is rendred proper to nourish the animal; the subtiler parts whereof penetrating as vapours thro' the Tunicks of the arteries and joining and uniting themselves to the Parts, nourish and augment them, and the

rest

rest is drained into the Liver, Reins, Pancrea's, &c and according to the Laws of Circulation repasses into the Veins, and from the Veins into the Heart, where it is refurnished with Spirits by the means of a Ferment, which is contained in its Ventricles, and by the Mixture of the Air, which insinuates it self through the Lungs into the Heart.

I could prove by many Experiments, That the pancreick Juice comes not from the Spleen Pag. 79. to the Pancrea's, as you pretend: But, as the thing is of it self, sufficiently clear, and that we need but observe the structure of these two Viscera's, and the communication that they have one with the
L
other,

146 *MrBoyle examin'd,*

other to convince you thereof:

It will be sufficient to cause you to take Notice of that which modern Anatomists have several times experimented, That after the Spleen hath been taken from Dogs, the Wound being consolidated, these Dogs have been as well as if they still had their Spleen, and we draw a pancreick Juice therefrom, altogether like that which we ordinarily draw. Wherefore, if the Spleen did communicate this Juice to the Pancrea's, it is certain, That these Dogs, whose Spleen was cut out, would languish, and Nutrition would no longer be perfectly made, because the Chyle is not fermented with the Bile, for want of the Pancreick Juice, which is the Menstruum

Acid & Alkali. 147

struum that dissolves these two Bodies, and which puts them in action : there would also be no longer any secretion of the Cream of the Chyle from the Excrements, and we could not be able to draw a Pancreick Juice from these Animals, for the Cause being remov'd, there is no longer any Effect, *sublata Causa, tollitur Effectus*. The pancreick Juice comes not then from the Spleen to the Pancrea's but is a Liquor which is strained in the Pancrea's as the Serocity in the Reins.

It is not a vain Fancy, as you go on, to believe, That the Lympha is a Serocity which is separated from the Blood, and from the nervous Juice in the Glands: if you had examined the suba

Pag. 837

stance of the Glands, and the Vessels which terminate thereunto, you would judge otherwise thereof: You would see, that the Glands are as so many strainers, through which the Serosity is strained, and there terminates thereto four Sorts of Vessels, namely Nerves, Arteries, Veins, and the Lymphatick Vessels; the Arteries carry Blood thereto, which the Veins re-carry to the Heart, according to the Laws of Circulation, the Nerves carry the animal Spirits or nervous Juice thereto, and the Lymphatick Vessels draw thereto the Lympha, and is discharged thereof, as I have already said, into the thorachick Pipe, and into the descending Vena cava: You see

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see from hence, That since the Glands have no other Vessels which administer thereto but Nerves and Arteries, it necessarily follows, That the Lympha is a Serocity which is separated from the Blood, and from the nervous Juice in the Glands.

You say, There is neither Acid nor Alkali in the Seed, because that being the Decidu of Pag. 109. [or that which is fallen off from] all the Body, and the Recidu of the last Aliment, it suffers neither the one nor the other: since they have been separated therefrom in the first Concoction of the Aliment, and are not to be found in the second, which is the Hæmatose, and yet less in the Third, which is the assimilation,

lation, or Nutrition of Parts.

You add, That if there were Acid and Alkali in the Seed, it would be destroy'd by the continual Ebbulition and Fermentation which is made thereof. It is to be admired that you can be of this Opinion, seeing according to the Doctrine which you would establish, you cannot deny, but the seed hath the same Principles, as, Flesh, Blood, Bones, Horns, and other parts of Animals, and 'tis otherwise indisputable, That Meat, Blood and Milk which grow sour when they corrupt, contain Acid and the Volatile Alkali's which are drawn in abundance therefrom, are Proofs no less certain, That there is an Alkali therein; whence it follows, That these

Acid & Alkali. 151

two Salts are also to be found in the Seed, since according to what you affirm, It is only the Residue of the last Aliment of ~~the~~ those parts: as for the Objection which you make, That if there were Acid and Alkali in the Seed, it would be corrupted because of the continual Fermentation which is made theteof: You shall also observe, That these two Salts never act, except they be dissolved or excited by some external Agent, as Heat, or by the mixture of some other Body: as it happens, when the Seed of the Male and that of the Female come to be mingled together, and to be heated in the Womb, for then all their parts are put into Motion, and there

is made a Patern or rough draught of all those of the Fœtus: the more subtile parts of the seed retire themselves to the Center, and scatter to the Circumference those which their grossness or figure render less proper for motion, from which are produced the Membranes which environ the Fœtus; and the more subtile parts continue their motion in the middle, dis-intangling themselves from those whose figure is not proportionable to theirs, and uniting themselves to those which are with them conformable; and so those which are Decidued [or fallen] from the Brain, or more properly those which are found proper to form the Brain, unite together and
pro-

Acid & Alkali. 153

produce the Brain. Those which ought to form the Heart, unite together and form the Heart, and so of all the other parts: and when it happens that the Man's Seed overpowers that of the Woman's, there is formed a Man; as there is formed a Woman, when that of the Woman's is stronger than the Man's: and we may believe that there may be an Hermaphrodite when both Seeds meet together in a perfect Equality.

Where you begin to treat of Acid and Alkali; you tell us, you can hardly give your Opinion thereof, because it is difficult to decide it upon a matter which ('till now) is undetermined: yet nevertheless you,

as it seems, decide it so absolutely, as if it were the most known and determined Truth in this World.

Fig. 26.

You pretend, That Acid is a principle of Death, and the Alkali a principle of Life, that is to say, That Acids are the Destroyers of Bodies, and Alkali's on the contrary, the Authors of their Construction. For to make the Probability of this Maxim disappear, one need only to make reflection upon what I have spoken thereof in my Discourses upon Acid and Alkali, where I have spoke of the Regeneration of compound Mineral Salts, and the Essential Salts of Plants: for, it is most certain, That Acids are not the destroyers of Bodies,

nor

Acid & Alkali. 155

honor Alkali's their Authors, since
all Alkali's are determined by
Acids, to make Bodyes of the
same Nature with those from
which they were drawn : and
if it happens sometimes, That
Acids destroy some Bodies, as
common Sulphur doth Iron,
that happens because there is
little Alkali to be found in those
Bodyes, and the Acid being in-
tangled therein, in a great deal
of Earth, it may easily be dis-
tangled therefrom by another
Acid, the which intirely de-
stroyes the Composition, but
that happens not in those Bo-
dyes where the Acid is fixed,
and united intimately with its
Alkali, as it is in Gold, Silver,
&c.

You bring us Tartar of Wine
for

893 for the first of all Acids, and you
prove it after so convincing a
manner, That the same Reason-
ing may be applyed in all its
force to all the other Tartarss
of Vegetables. It is the first,
say you, in its generation and
Action: it is the first in its ge-
neration, because it is produc'd
such by nature, for it is in
Grapes together with the Al-
kali of wine, and so long as
Nature governs them they
have not any motion of altera-
tion one against the other, &c.
but as soon as Nature doth cease
to govern them, they ferment
themselves one with the other
into Wine, &c. May not the
same thing be said of all the
other Vegetables? They have
all their Acid and Alkali pro-
duced

Acid & Alkali. 157

duced such by Nature, they are not disunited but when Nature ceases to govern them, they are fermented in their Juices, as the Alkali and Acid of Grapes are in Wine.

You are not contented to assure us, That Tartar is the first of Acids, but also, That its Acid consists in its Salt, and, That that which is distilled therefrom, is the Volatile Alkali of Wine, which this Acid had absorbed. The Anatomy of Tartar will perhaps make you be of another Opinion, for there is drawn therefrom first a Flegm by Distillation; Secondly, an Acid Spirit, which ferments with all Alkali's: Thirdly, a stinking Oil, and lastly, a fixed Salt, which is separated from
its

its Caput Mort. by Lixiviation,,
 which ferments with all Acids,,
 and precipitates Vitriol of Mars
 dissolved in Water.

The Acid spirit of Tartar is
 of the same Nature with that
 of Vinegar, as may be seen by
 this Experiment.

℞ some Salt of Tartar, and
 pour thereupon good Vinegar,
 until it will take in no more,,
 and there will be made a rege-
 nerated Tartar like to that of
 Wine, whose sourness is gone:
 You may perceive then by this,
 That that Spirit which is drawn
 from Tartar, is not the volatile
 Alkali of Wine, which the Tar-
 tar had absorbed, as you teach
 us; but it is, on the contrary,
 the volatile Acid of Wine, which
 causeth it in time to degene-
 rate

Acid & Alkali. 159

ate into Vinegar. The black
and stinking Oil which went
forth after the Flegm and Spi-
rit, is an enveloped Acid, as are
all the Oils of Vegetables. In a
word, The Salt that is drawn
from Tartar is as powerful an
Alkali as any there is in Na-
ture, which, as I said even now,
ferments with all Acids, and
does precipitate Vitriol of Mars
dissolved in Water.

It seems also you have ac-
knowledged this Truth, when
you said, That Oil of Tar-
tar made *per deliquium* (which Pag. 97.
is no other thing but fixed Salt
of Tartar dissolved in some
Flegm) did ferment with the
spirits of Salt, Vitriol, Sulphur
and Niter, and did precipitate,
after the Fermentation, some
Matter

Matter from those Bodies: Oil of Tartar is therefore an Alkali, since it ferments with Acid Spirits; for, as you grant, there is none but Alkali's which can ferment with Acids; and, it is false that you assure us, That this Oil is Acid; for, if it was Acid, it would ferment with Alkali's, and never with Acids, the which is contrary to what we see.

Pag. 98,
99, 100.

The Reason which you render of the Effervescence which happens in the Dissolution of Metals in Aqua fort. is a Subject as little satisfactory: for, you say, That it is not the Aqua fort. that causes this Dissolution and Effervescence, but rather a volatile sulphurous Spirit which animates the Aqua Fort.

Acid & Alkali. 161

Fort. to the Dissolution of the Mettal, since that being evaporated, or separated therefrom by the Acid of Salt of Tartar, the rest of the Water acts no more; for, assuredly (continue you) it is this imperfect, or to speak more properly, embrionated Sulphur which symbolizeth with the Sulphur of a Mettal, and more or less with one than with another, whence come the Diversity of Aqua fortis; and, that one acts upon one Mettal and not upon another, &c. This Sulphur is impatient for a union with a Sulphur more perfect than it self, therefore it searches through the Mercury, and striving to be united with it *per minima*, it divides it, &c.

M

Ex-

Experience fully destroyes the appearances of this Reasoning; for, it is most certain, That Acids, as Spirit of Niter, dissolves imperfect Metals, which have more Mercury than Sulphur, as Silver, Lead, &c. and, as for Gold which hath a great deal more Sulphur than Mercury, it cannot be dissolv'd but in salt Menstruums, as Spirit of Sea-salt. I have explained all these different Effects so clearly, in the preceeding Discourses of this Book, That the repetition thereof would be both useless and troublesom: And, as to the Hindrance that Oil of Tartar brings to those Dissolutions which you attribute to its Acidity, It is not at all probable; since I have formerly

Acid & Alkali. 163

merly shewn, That it was an Alkali: and the true Reason of it is, That the Oil of Tartar being a powerful Alkali, absorbs the Acids which held the Metals in Dissolution, and the Metals being no longer agitated or stir'd by their points are precipitated into a powder, to the bottom of the Vessel.

Truly, I see as little Justice in your Definition of Alkali; You argue it to be a thing made Salt by Cremation, as though it was not a Salt before: and, this Definition doth in no wise explain the Nature of Alkali, but only agrees with fixed Alkali: yet it is certain, that some are Volatile, which are elevated & sublimed with the least Heat, as your self acknowledgeth, where

Pag. 102.

pa. 94, 95.

M 2

you

you speak of Tartar : You say, It retains the volatile Alkali of Wine. which causeth it to break the Vessels by its combating with the Acidity of the Tartar, when it is distilled alone by Retort, The Recipient being very exactly luted, & the fire too much prest. But I have moreover sufficiently formerly proved, That Alkali as well as Acid was actually in all Bodies; and, that to be Alkali, it is not necessary, that a Body be made salt by Cremation. Moreover, the Doctrine which you pro-

Pag. 104. more contradicts it self; for, if
105 the Alkali was no other, as you would have it, than only the Sulphur of the Mixt retained in a portion of water under the form of Salt by the disposition

Acid & Alkali. 165

position of the fire, it would most easily be destroy'd, and consequently, as Volatile as you pretend it fix'd.

That which you say of the Liquor Alkahest of Helmont, and the Doves of the Diana of Philalethes, appears to me so frivolous, That I think it not worth my stay to refute it, no more than several other Passages of your Letter. It sufficeth me to make you know the principal Points wherein you have deviated from Experience and Reason: and also to make you take Notice, That it is much more honorable to keep Silence than to employ your Time and Pen unjustly to censure the Works of others, and to rage

M 3 and

166 MrBoyl *examin.d.*¹³

and rail without Reason, or any
seeming Truth, against a Facul-
ty whose Credit and Reputati-
on you are in Justice obliged to
vindicate.

FINIS.

Errores

PHLEBOMIÆ

DETECTI.

THE
JOURNAL
OF
J. J. J. J. J.

Errores
HLEBOTOMIÆ
DETECTI.

Or, The
ERRORS
OF
HLEBOTOMY
DISCOVERED,

showing its absolute Evils, together
with the accidental Benefits there-
of, in some Cases.

For the Use of Tyro's:

By J. W. Philoſophus.

L O N D O N,

Printed by Thomas Dawks. 1689.

Errors
HALFOTOMY
DETECT

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ERRORS
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Πλανάι Φλεβοτομίας [Σπουδαλυνμυραί:

Sive

Errores PHLEBOTOMIÆ
detecti.

THAT Phlebotomy should be without its Errors is strange, since all humane Operations are subject to Mistakes; for, *Humanum est errare*: but, That these Errors should be maintained with so much Stifness, when Reason and Experience daily demonstrates them to be contrary to the safest way of Healing, is most strange! because, such Persons must needs either obstinately despise the Dictates of Reason, and go on in their old Dangerous roads, meerly for want of knowing better, or to excuse themselves

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from

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from those more troublesome tho' safer ways: Or else such persons shew themselves Uncapable to be taught by Reason or Experiments, by paying too great a Veneration to some few Opinions of our ancient Physicians, as well as to the Male-practice of our European Neighbours.

Methinks, where the Lives of our miserable fellow Brethren are so nearly concerned, we might be the less rash and inconsiderate in our Practice, especially, if we are not so horridly wicked as to be void of all Thoughts of a Future State, wherein we shall either receive the just Merit of our unchristian Actions in endless Torments, or, the gracious reward of our charitable and just Endeavours in eternal Enjoyments.

And, That Phlebotomy, as it is now rashly and carelessly used, may appear to be in many Cases, dangerously and cruelly inflicted upon Mankind by unthinking and partial Physicians: Give me leave to present you with these following Reasons to prove it.

First

First, The Blood is by all granted to be the Vehicle of Life, and that whereby Nature performs all her Operations : and, as the Blood is an Instrument of Nature, so it is a Product of Nature, which is proved by comparing Childhood and Maturity together ; a Child hath not so much Blood as a man ; therefore it is necessary it should have its generation and augmentation, which can only be by what it had a beginning from.

Nature also doth not generate or augment the Quantity of the Blood in vain, and this is apparent, because all Philosophy maintains, She doth none of her Works in vain, but for the end of Health and conservation thereof. Now, it follows, That the Diminution of that which Nature hath ordained for Conservation, must produce a Chasm in the matter to be conserved : this may be proved in any continued Matter, whether Lines, Superficies or Solids, for, the matter conjoined being dissolved the Matters conjoined are separated. Now, a Chasm cannot be made without Loss of some Intention of Nature, if it could, it

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would necessarily follow, That the thing; making the Chasm was made in vain, which is notoriously against the Principles of Philosophy: and, a Loss of any of the Intentions of Nature, is in order only to her Dissolution, because it obstructs Nature in her Constructive and Conservative Operations; and a Dissolution of Nature will produce a Destruction of the humane Frame.

And, it must needs be so, because Nature her self, being Conservatrix, is taken away. In Nature lies the band of Union by which all Particles and Parts of the Body are knit and joined together, and this Band is only in the Medium of Life; for, there is no Difference between the Medium of Union and the things to be united; This Medium is the Blood, and the things to be united are the humane Frame and Life: Indeed, it is the Life it self that is the Real uniting Principle, which because it is immaterial and so without Parts, and not capable of Division of it self, so it is impossible to be disunited from any thing it is joined, unless the Medium of that Con-
junction

unction be first destroyed which is first begun by a Chasm; and, as a Chasm is the Medium of the Separation of united things, so the Diminution of the Medium of union is a Diminution of the United Forces, and consequently an Inlet to the Destruction of the conjoined Principles: for, the Medium of Union adds strength to the things united by Virtue of their Conjunction or being made one, for, *Vis unita fortior*; hence it is evident, That the Abstraction of that Medium must be the Dissolution of that Strength, and proportionable as that Medium is augmented or diminished, so must the Strength of the conjoined things either increase or decrease: and, I have before proved, Nature doth nothing in vain.

From all which it follows,

That the taking away of the Blood, *First*, Hinders Nature in performing her Operations. *Secondly*, Diminisheth her Generation. *Thirdly*, Frustrates her Intention. *Fourthly*, Diminisheth the Medium of Union. *Fifthly*, Impares the strength. *Sixthly*,

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Sixtly, Opens a Casm, which being sufficiently wide lets out Life, and introduceth Death. Wherefore since a diminution of the Quantity of the Blood cannot be done without manifest Damage, the Alteration of the Quality, when it is hurt, ought to be attempted some safer way.

And, whereas it is generally believed That Blood-letting often prevents a Fever, yet if we examine the thing more accurately, we shall rather find, That it makes us obnoxious to a Fever. It is the Opinion of that great and learned Champion for Blood-letting, Dr. Willis, in his Book of Fevers, pag. 75. *Præ cæteris vero observatione constat quod Crebra sanguinis missio homines febricitantes reddat: and again, hoc fit, ut qui Crebra mittunt sanguinem, non tantum in febres sunt proclives, veram etiam pinguescere soleant propter crassum succo sulphureo plus impregnatum.* But whether this sulphurous Juices is the true Cause of either, I shall not attempt to examine: since it is also the Opinion of divers learned Physicians, That Blood-letting, by cooling the Body in depriving

priving it of its vital Spirits, does so qualify it, as it cannot cast out that dewy excrementitious substance which sweats through the Tunicles of the Veins (which is the Matter of Fault) by Perspiration, but suffers it to congeal under the skin in that thick pingueous Substance called Fat: Hence Persons that are coldly constituted are fat without Phlebotomy: and hence also it is, That fat persons are the smallest Eaters, by reason of the lack of internal Heat. But a little after the Doctor speaks yet more fully to the Purpose, *Qui sanguinem habent sale volatilizzato bene saturatum, ii sunt minus Febris obnoxii: hinc etiam qui saepius sanguinem emittunt ad Febres aptiores sunt.* Thus far the whole single Testimony is sufficient.

And, since it appears, That it doth so little hinder the approach of a Fever that it rather furthers it, it seems impossible That it should absolutely and alone cure any Fever. For, it is granted by all Physicians, That a Fever has a property to pollute the Blood, and, that this can be taken away *a posteriori*, that is, by withdrawing
what

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what is putrified and contaminated, seems
 very absurd to think, being contrary to that
 Philosophick Axiom, *Manente causa, manet effectus*. Besides, It is generally be-
 lieved, That the material cause of a Fever
 do's not possess the Vessels about the heart
 but rather the *Vena cava*: and therefore
 how can Blood-letting be supposed to re-
 move either, the efficient or material cau-
 ses thereof? Wherefore consequently, it
 can be no true Remover of a Fever, but
 only an Abater of one of its most trouble-
 som Symptoms, *viç.* Heat: which it do's
 by impoverishing the Stock of vital Spirits,
 which maintaining Contest with the Radix of
 the Fever, does by that contentious Moti-
 on cause that preternatural excessive Heat
 and Ebullition of the Blood, which is particu-
 larly affected therewith: hence it is
 That old Persons, whose vital Spirits are
 poor in quantity, and consequently not
 able to combat so strongly with the Dis-
 ease, do not appear so hot in a Fever as
 those whose Spirits are stronger, and in a
 larger quantity: and other persons after
 a tedious Warfare with this cruel Disease,
 some

Some small time before Death, the Spirits having given up the Victory, as not being able any longer to oppose the same, do them to be totally freed from all the Symptoms of their Fever: For, as I said, the Spirits by reason of their Paucity and Imprecility do then resign up their noble Members to the Mercy of the Disease, whose virulent Forces quickly invades the very Royal Pavillion of Life it self, and as suddenly subverts it, by committing it into the frozen Arms of a drowzy Death.

Whence it is held as a dangerous Prognostick when a Fever abates in the Violence of its Symptoms, without any CRISIS or natural Assistance, or without any medicinal Aid, or without any certain Signs of approaching Health, as well as sure Tokens of Nature's obtaining the Victory over the Disease.

So that it is no Wonder why Phlebotomy seems to afford so great Refreshment to the afflicted, even in the most troublesome symptoms; because, by depriving Nature of

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of some of her provoked Forces, it compels the rest for want of Power to suffer patiently the Cruelty of the Disease, which if it be not very malignant, as those Fevers called *Ephemera*, *Synochus non putrida*, and sometimes in those putrid ones called, *Synochus putrida*, and the continual *Quotidian*, *Tertian* and *Quartan*, the Contention ceasing, and the corrupted blood being partly let out, and the rest (by some proper Medicament) being corrected and amended, Nature doth with much Difficulty, and with great Debility at length obtain a pleasing Health.

Now, if Phlebotomy did only let out the corrupted Blood, and left still behind those Spirits which used to flow with it, then Blood-letting, by partly removing the Effect, might ease Nature of a great deal of that, which she otherwise must with abundance more Toil cast out: And, Reason would tell us, That the natural Forces being still the same in Quantity and Power, and the Inimical vitiated Blood being diminished and partly let out, Nature must
preds

needs be the better able to cast out and
urge the rest. But, since we find that the
Blood and Spirits are Correlatives, and do
tue out together, the Spirits going forth
in such Quantity, and the Blood let forth
could be Vehicle too. This proves then
That Phlebotomy as it doth take away some
of the corrupted Blood, so it takes away
also those Spirits which might have assisted
to its correction some better way: thereby
rather weakning than assisting Nature.

But Phlebotomy being used in any ma-
ignant Disease is utterly destructive with-
out a Miracle: for, in the Meazles, Small
Pox, Plague, &c. It most commonly ob-
structs Nature in her Intentions, so much
debilitating her strength, that she oft proves
unable to cast forth the malignant Matter,
but by its poison is wholly over-come and
destroy'd, or, at least is not capable of ma-
king an exact Purgation; and though with
extream hazard, she escape Death; yet
there is such a stock of malignant matter
left behind secretly lurking in the Mass of
Blood which will, upon a small Excitation,
dis-

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discover its presence there by untoward troubleſom Symptoms, unleſs by powerfull Remedies it be diſpoſſeſt before it has fermented it ſelf to that height.

It has been the Audacity of ſome Phyſicians to preſcribe Blood-letting even in the Small Pox and Plague, ſuppoſing That in the firſt, the corrupted Blood being partly let out, it would be impoſſible that thoſe afflicted perſons ſhould have ſo many of thoſe deforming Puſtles, as they otherwiſe would have had; and therefore Blood-letting in ſuch Caſes might be lawful, if it were upon no other account but the preſerving the threatned Beauty of youthful Face. 'Tis true by allaying the Efferveſcence of the Blood, and weakning the expulſive Faculty, partly, as they ſay by reaſon part of that Corruption is let forth, which otherwiſe, perhaps, might have made ſome hundreds of thoſe filthy Puſtles: There is, (if the Diſeaſed eſcape Death) a great diminution of them, and thereby thoſe ſweet Features which they before poſſeſt are not wholly rafeſced. But

But that this cannot be performed without manifest Hazard of the Patient's Life, Experience and Reason hath shewen, since so many great Persons have sell meerly to save a handsome Face. The Spirits by Blood-letting being diminished and enervated, so that they can no longer endeavour for their own Recovery: for, as Hippocrates saith, *Natura est morborum Medicatrix*. Besides, Phlebotomy generally, by weakning the retentive Faculty, produces a Diarrhæa, which was ever accounted a dangerous Symptom in malignant Diseases, but most particularly in the Small Pox: and, upon this Account it is That Phlebotomy sometimes by producing this accident, cures a simple Feaver.

But, In the Plague, they pretend That the opening of a Vein is necessary for Prevention sake, Because the less Effervescence is in the Circulation of the Blood, the less obnoxious we are to the Contagion. The most noted man of this Opinion, I find to be the above-mentioned Dr. Willis, in his Book of Fevers, pag. 157. Where he saies,

O

Ubi

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Ubi adest Plethora cum magna sanguinis Turgescentia, aut quibus longa Consuetudine sanguis solenniter mitti solebat iis venam secare convenit, quo enim sanguis minus effervesceat & sine tumultu in vasis circulat, eo tardius Lue pestifera Contaminatur. A most injurious Opinion, since by weakning the Spirits, she becomes the less able to withstand so lethal an Enemy:: For, if a Plenitude be the Pretence: by a more spare Dyet, and other proper things, it may be made so harmless as not in the least to assist that poysonous Disease, when it has seized us, nor to encourage it in any way to seize upon us.

Wherefore to go and let any infected person Blood, is a short Way to Cure them of the Disease, and Rid them of their Livers together: since it so wastfully spends these vital Powers, by whom only this cruel Disease can be withstood and vanquished. For, if Nature, at any time has so far prevailed with the Disease, as to collect the greatest part of the malignant Matter into one place, and does endeavour to cast it forth

im

in Botches, Boils, or Carbuncles : which commonly appear in the Emunctories : whose Glandules are then tumified with this poysonous Humour : Blood-letting being then admitted, Nature dos not only for want of Power cease to prosecute her design, but this vicious Humour is remitted *ob fugam vacui*: and so quickly spreads it self through the whole Mass of Blood, assisting those poysonous Particles (which were there before, and which Nature was obstructed, by Phlebotomy, from purging out) to the destruction of the miserable Patient.

It is for the very same Cause that those common Breakings out of the Body, in large Swelling, in the Emunctories, and in small Pimples and Scurs, all over the Body do all disappear after a plentiful Emission of Blood: The vitiated Matter being returned to supply the Deficiency of the Blood newly let out: and, it is there so long circulated 'till it is thence cast out by Perspiration: or else, if it be very venemous, it infects the whole Mass: so

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that, perhaps, an accute and dangerous Disease succeeds it, and if it be neither very Malignant, and Yet the whole Mass be contaminated, those Pimples, Blisters and Scurff keep so long in and lurk secretly in the Blood: either 'till Nature has recruited her Forces, and begins to cast them out again, in order to the freeing herself from those noxious Particles (tho' perhaps it be impossible for her alone and unassisted to perform it, yet she always endeavours her own Redemption if she be not obstructed) or else, 'till those Venemous Corpuscles are by some accidental Cause excited to fermentation, whereby they pollute the Blood to a greater degree, so that the whole Flesh is so depraved as to appear in a Measly Scurfy and filthy form, and may, perhaps, at last merit the name of Incurable Leprosy.

It is the Opinion of some Physicians, That Blood-letting is very proper, yea, Necessary in the Scurvy: among whom I find the often quoted Doctor *Willis* to be one, who saies, in his *Book of the Scur-*

vy, pag. 256. *Cum enim Liquor sanguineus valde impurus evasit nullo Remediorum genere certius emendatur, quam crebra & parva extramissione, quippe sanguini veteri corrupto quoties educitur recens melior & defecatio existit.*

Now, theretore it is granted by Most, That the Blood is better in some venal Pipes than in others, which may easily be proved by any who ever saw many rob'd of this rubid Liquor: for, In some it spouts out Bad at first, and better afterwards: in others, The quite contrary: Wherefore, if this be true, as it most certain and undeniable, Then the Question is, How shall we know when that vitiated parcel of Blood, which we so much seek to remove, has taken up its abode in the inferiour parts of the Veins of the Arm, and in the Arteries tending thereto, that we may let it out: For, if it be not there, it is impossible we should extract it: since all the other Arteries are too re-

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mote : and, so in stead of the *Bad*, we may take away the *Good* : and, besides if we did take away some of the *Bad*, for its impossible to take all, yet it may be questioned, Whether the new-made *Blood* may not be vitiated in its Preparation, before it comes to be circulated with the old, as undoubtedly it is, both in the *Liver*, *Spleen* and other *Viscera's* : Wherefore, tho' a new *Mass* of *Blood* may well be expected this way, yet not without a cruel wracking of *Nature*, in forcing her to labour so hard for *Life*, being before tormented by so stubborn a *Disease* : yet we cannot expect to have it much better than the former, but rather worse, unless we use some proper Remedies to cut off the *Causes*, and to purify it in the *Fountain* ; the which Remedies would as well have corrected and amended the *Old Mass* of *Blood* as this *New* one, since no *Blood* in a curable *Disease* can be so corrupted, but it may be reduced to its pristine *Sanity* without extramission of
any

any part of it: which proves, That its not a Real Corruption, but a Disposition thereto: for, an absolute Corruption is a total Destruction of its first Essential Form, and the Assumption of a new one, which by no means will admit of being reformed into its pristine one, according to that Philosophical Axiom, *A privatione ad habitum non datur Regressus.*

Yet we finde, That the Blood, tho it seem to be deeply corrupted, may easily with proper and efficacious Medicaments be restored to its former Soundness and Purenets, because it has not totally lost that Form with which it was first fram'd.

But, yet further, Suppose the Scorbütick Malignity did lodge no where but in the Blood [which is indeed false] yet new Blood coming to be circulated with that old which was left, would by meer contact be, in a small time, equally affected by those noxious Particles, as that: Such a fermentative

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Force has the Seminal *Ens* of a Disease, as it can quickly multiply it self to a Wonder, if it be not restrained or cut off. Wherefore Blood-letting in these Cases does not appear, being Examined by Reason and Experience, to be so very Necessary, as some would make us believe it is.

Therefore to make an End of all, it appears, That the Means used to let out bad Blood, without removing the Efficient Cause thereof, is no direct Method of Healing.

Now, Phlebotomy lets out bad Blood without removing the Efficient Cause thereof; *Ergo*, Phlebotomy is no direct Method of Healing.

The *Major* is easily proved, For whatsoever suffers the Cause to remain can never totally remove the Effect: Now, Phlebotomy suffers the Cause to remain, therefore it can never absolutely remove the Effect.

The

The *Minor* is also as easily proved; For, if the Cause of bad Blood were cut off, the Fever and Scurvy depending thereon would quickly cease; the which we find rarely to happen, since after a frequent Extraction of Blood, we find the Fever and most of the Symptoms still remain, and the Disease grows more strong, even to a total deprivation of all the vital Faculties, of their Power and Vitallity.

I own Blood-Letting may do least Harm, yea be very Beneficial, by accident, in some Respects, in some few Diseases; of which the most noted are, a Frenzy, Quinsy, Pleurisy, an inveterate and stubborn Head-ach, and in some Fevers, which be in no wise malignant; as also in Contusions, Rheumatisms and Intermittent Fevers, but it must be in young and strong Bodies, if it be done without any cause of Fear; and in some few other Diseases: But especially, it is most proper to temper the plethorick Bodies of our age, who
by

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by an extravagant Destruction of vicious Liquors cause themselves to abound in that pretious balsamick vital Liquor.

It helps a Frenzy by abating the Effervescence of the Blood, in diminishing the Vital Spirits.

It helps a Quinzy by Revulsion and drawing back the Blood into the Veins which would have putrified there, that it may supply the loss of that which was let out.

In a Pleurisy, it obstructs also the Apostumation of the Blood collected in the *Pleura* and Intercostal Branches of the *Aorta* by Revulsion, for that Blood there ready to putrify, by reason of the great heat of the Parts, and its own Disposition to Putrefaction does, as the Blood is drawn out of the Arm, repass into the Superiour Arteries, and so becomes again circulated in them: the Abscess thereof being thereby prevented. It

It cures an inveterate Head-Ach by reason it appeaſes the Fury of the Spirits there, and by reason it depleats the Veins and Arteries, wherefore 'tis, they are not ſo diſtended and pained as before.

And, as for Fevers, I have told you already how it comes to be aſſiſting to their Cure, only intermitting Feavers accidentally are cur'd by altering the Circulation, and by putting Nature into a Fear of Death, wherefore ſhe muſters up all her Forces to oppoſe it, whereby very often the Root of the Fever is in this great Hurry and Commotion cut off and expelled: for, as *Dureti-
us* ſaith, *Animi actiones incidente aliqua occasione fortius agunt præſertim in mortuis*: Whence alſo in Swoonings and Apopleck ſits it proves beneficial: and, hence alſo it is, That great Fears have often been a means, by ſtirring up all the natural Forces for their own Safety, to rid ſome Perſons of chronick acute and almoſt incurable Diſeaſes,

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ses, as Experience has often manifested.

Rheumatisms it cures by Derivation, and so it doth some Coughs, by causing the sharp Lympha which Tickles the Lungs by its sharp pointed Corpuscles; these which also afflict the Nerves and Tendons with acute Pains, to be discharg'd from thence mediately into the subclavian Veins, to supply the loss of the Blood let out, and into the Mesenterial Glandula's, to be mixed with the Chyle; also to promote the speedy making the like quantity of Blood: hence sometimes doth the Cause of a greedy Appetite proceed after Blood-letting, and after the retreat of a sharp Disease: for Nature being studious to repair her loss, and especially When she has not been too much weakned by the Disease or Blood-letting, do's manifest her wants by these hungry Symptoms: It seems to assist the Circulation of the Blood, when it is congealed by reason of the Obstruction of its Circulation in the

the small Veins, which by the Contusion are so squeezed that they wholly deny its flux, because it seems to afford it more Room for that Circulation: but if we consider, That the Blood is Congleated only, as I said, in the smallest Veins, and that the thinnest and most fluid Blood spins out at the Orifice: we cannot think it can much further its quiet Circulation, since fluidity is the greatest Promoter of it.

Lastly, By its wasting the Spirits and depriving us of that pure nutritive Juice the Blood, it keeps us back, not suffering Nature to store up so much Nutriment to her self, and thereby renders us equally as needy as if we put a greater restraint upon our Appetites and indulged them far less than we do,

To the former Advantages by Phlebotomy, here is added, by another hand, this further Benefit, *viz.* That it is of excellent use for Women, when their

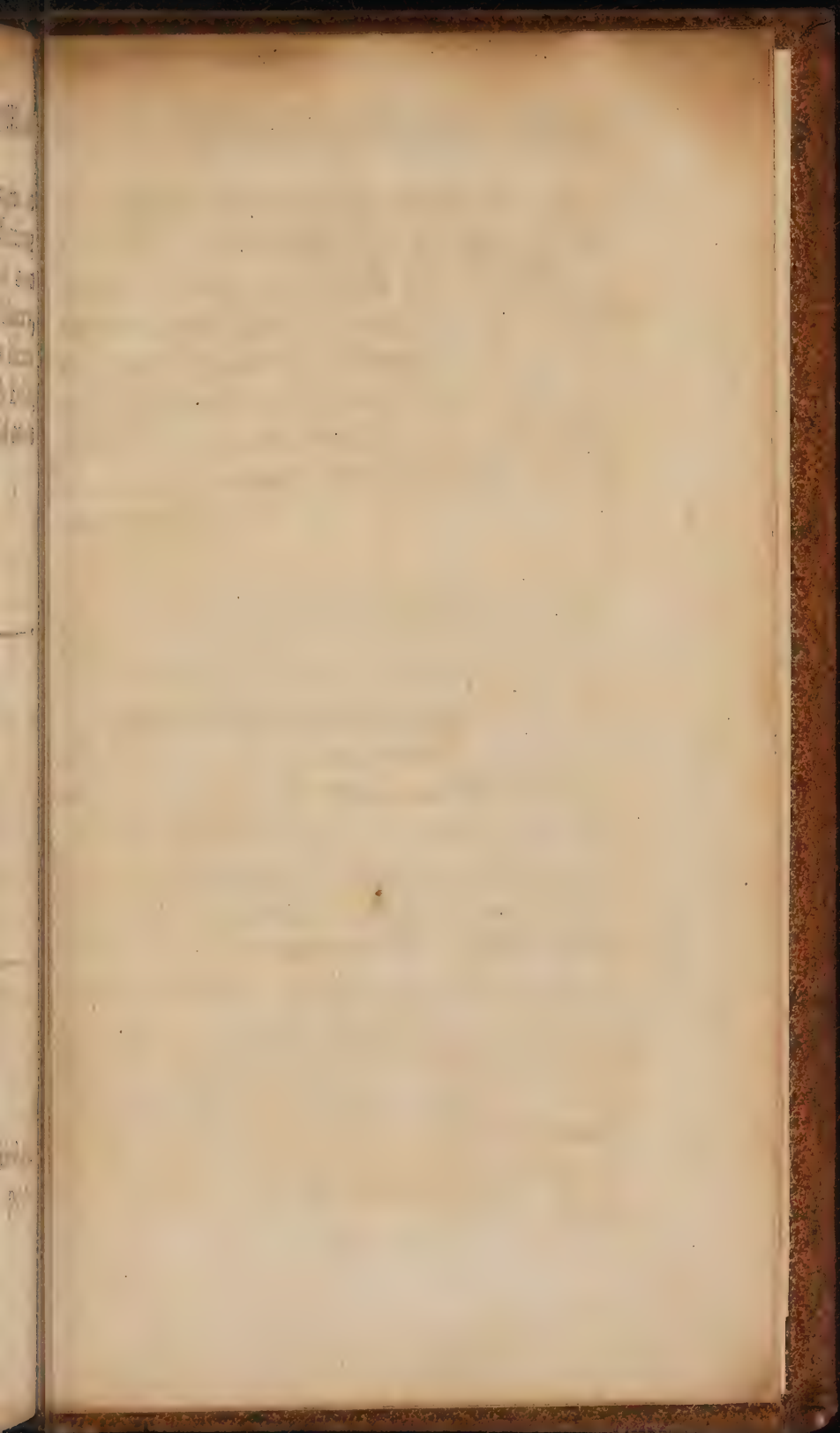
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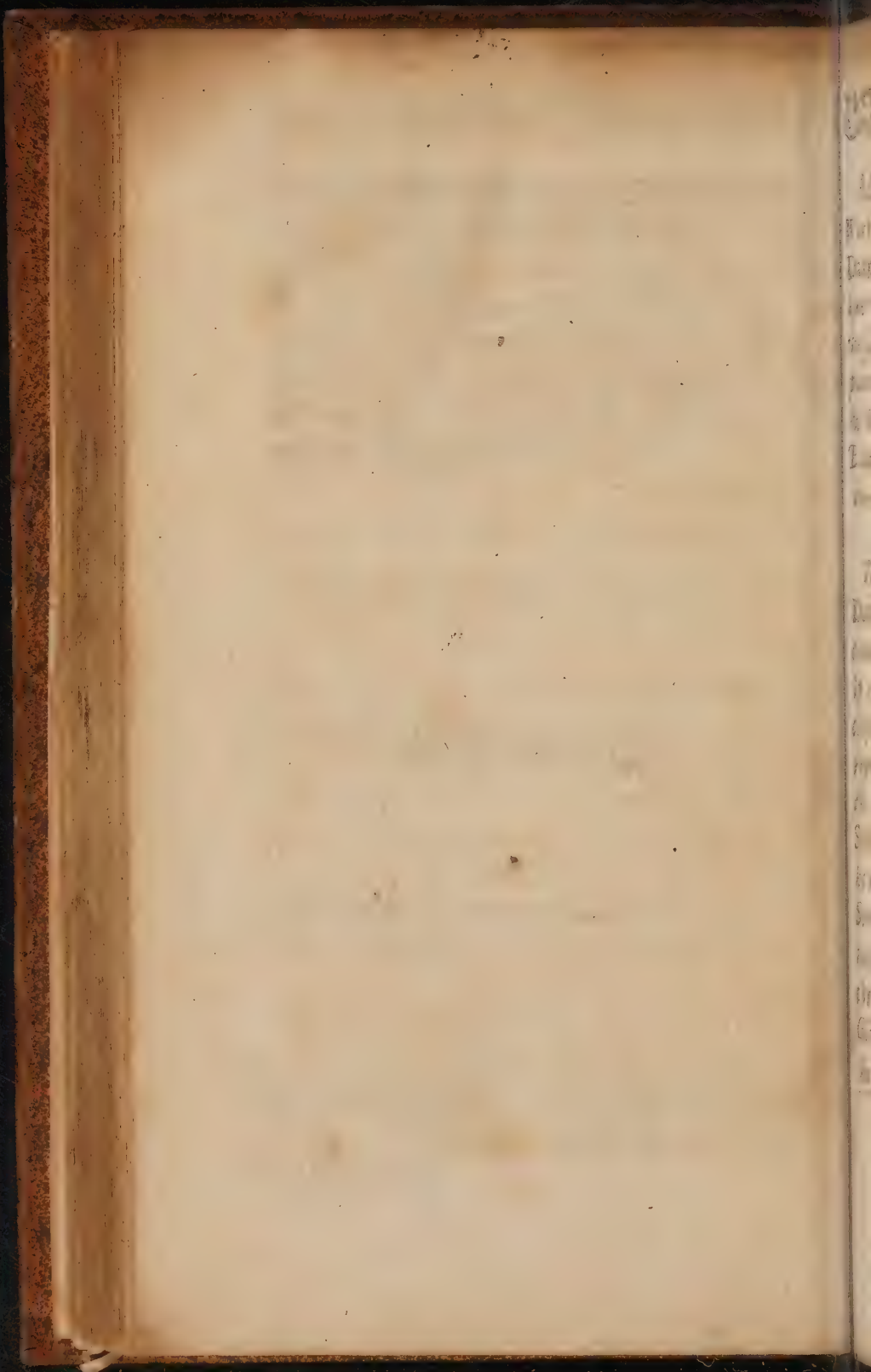
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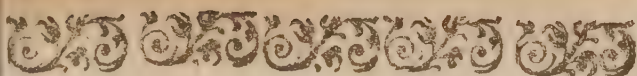
Terms doo'dg with them, and begin to leave them; and to prevent the settling of them in their Limbs, or in their own Vessels putrifying, and causing Ulcers, Sores, Piles and Fistula's in the inferior Parts, &c. to prevent all which Evils, Women so affected ought to bleed once amonth for 3 Months together,

FINIS.

Errores Phlebot. p. 10. l. 18. *Crebro*. p. 11. l. 5. *Fat.* p. 12. l. 6. *above.* p. 15. l. 5. *as the,*







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